Revised Draft Final Report

Class I Area Air Quality and AQRV Impact Assessment for the White Pine Energy Station

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1.0 INTRODUCTION

BACKGROUND

White Pine Energy Associates, LLC (WPEA) wishes to build a new coal-fired electrical generating facility in White Pine County, Nevada near Ely (the Project). As part of the preconstruction permitting process, air quality (AQ) and air quality related values (AQRVs) impacts at nearby Class I areas need to be evaluated. AQRVs consist of visibility and deposition. WPEA must show that the Project AQ impacts at Class I areas will not cause exceedances of any Prevention of Significant Deterioration (PSD) Class I area concentration increments and they must compare the Project's AQRV impacts at Class I areas with the FLAG threshold levels and provide this information to the State of Nevada and the applicable Class I area Federal Land Managers (FLMs).

This document represents the Revised Draft Final Report for the Project's Class I area analysis. Prior to undertaking the Class I area modeling, a Modeling Protocol was prepared delineating the procedures to be used that was distributed to the State and FLMs (Morris, Jia and Lau, 2005). The FLMs provided comments on the Modeling Protocol that were incorporated into the analysis. The initial Class I area impact assessment of the Project was presented in a Draft Final Report dated June 6, 2006 (Morris, Jia and Lau, 2006). The FLMs submitted comments that they would prefer that a 1 ppb background ammonia value be used in the Class I area CALPUFF modeling analysis. The FLMs also requested that a cumulative Class I area SO2 PSD increment consumption analysis be conducted for years, Class I areas and averaging times that the Project's SO2 impacts were estimated to exceed the single-source Significant Impact Level (SIL). Consequently, this Revised Draft Final Report presents the Class I impact analysis using the FLM recommended 1 ppb background ammonia value and also includes the cumulative SO2 Class I area increment consumption analysis.

Class I Areas of Interest

WPEA has discussed the proposed Project with the FLMs and the FLMs identified two Federally mandated Class I areas within 300 km of the Project where AQ and AQRV impacts were estimated (see: Figure 1-1 reproduced from http://www2.nature.nps.gov/air/Maps/classILoc.cfm):

- Zion National Park, for which the United States Department of Interior (USDOI) National Park Service (NPS) is the applicable FLM; and

- Jarbidge Wilderness Area, for which the United States Department of Agricultural (USDA) Forest Service (FS) is the applicable FLM.

As shown in Figure 1-1, the Project location in the western U.S. is optimally placed near the eastern Nevada border within a "hole" of Class I areas. This location maximizes the distance between the Project and any Class I area thereby mitigating any potential impacts at the Class I areas to the maximum extent possible.

Figure 1-2 displays the locations of the proposed Project and the Zion National Park and Jarbidge Wilderness Area Class I areas that lie approximately 300 km to the south-southeast and 260 km to the north of the proposed Project, respectively. Figure 1-3 displays receptors within 300 km of the proposed Project that were used in the Class I area AQ and AQRV assessment for the Jarbidge and Zion Class I areas. Note that portions of Zion National Park lie further than 300 km from the proposed Project (Figures 1-1 and 1-2); AQ and AQRV impacts were only assessed at receptors in Zion within 300 km of the proposed Project as requested by the FLMs.

Overview of Approach

The CALMET/CALPUFF modeling system was used to estimate AQ and AQRV impacts at the two Class I areas. The basic procedures used in the WPEA Class I area AQ and AQRV impact assessment followed the guidance from the Federal Land Managers Workgroup (FLAG, 2000), Interagency Workgroup on Air Quality Modeling Phase II (IWAQM, 1998) and EPA's latest revised April 15, 2003 Air Quality Modeling Guidance (EPA, 2003a) with updates developed since their publishing and are summarized as follows:

- Modeling Period: The Three years of 1996, 2001 and 2002, during which MM5 meteorological model output are available, were used in the analysis.
- Emissions Data: WPEA provided emissions data for the proposed Project. Maximum allowable emissions were used in the CALPUFF modeling.
- Receptors: The two Class I areas of interest are the Jarbidge Wilderness Area (JARB) and the Zion National Park (ZION) for which the USDA FS and USDOI NPS are the FLMs, respectively. The NPS has a database of recommended receptor locations for Class I areas that were used in this analysis, eliminating any receptors further than 300 km from the proposed WPEA source.
- Source of MM5 Data: The Class I area impacts were estimated using three years of data for which Mesoscale Meteorological (MM) model data are available. The 1996 36 km MM5 data developed by EPA and used by WRAP for their Section 309 SIP modeling were used as input for the 1996 annual modeling. This data was processed by ENVIRON for the NPS to generate CALMET MM.DAT input files. More recently, EPA completed 2001 36 km MM5 modeling of the continental US that was used in the analysis for the 2001 annual CALPUFF modeling. There are currently several 2002 MM5 databases for the continental US developed by VISTAS, WRAP and CENRAP. The WRAP 2002 MM5 modeling has been configured to provide better model performance for the western US (Kemball-Cook et al., 2005) so was used in the annual modeling analysis of 2002.
- Observed Meteorological Data: Observed surface and upper-air National Weather Service (NWS) meteorological data within and nearby the CALMET/CALPUFF modeling domain were acquired, subjected to quality assurance (QA) and reformatted for input into CALMET.
- Modeling Domain and Configuration: The extent of the modeling domain was defined based on an examination of the sources and receptors of interest and terrain data. In the direction from the proposed WPEA to the Jarbidge and Zion Class I areas, a minimum 350 km distance was included in the domain to allow at least a 50 km buffer past the furthest receptors of interest. The modeling domain was defined using a Lambert Conformal Conic Projection (LCC). A 1 km grid resolution was used.

- CALMET Parameters: CALMET parameters were defined following the standard default CALMET application with enhancements based on our experience in CALMET modeling.
- CALPUFF Parameters: Standard default CALPUFF parameters for PSD applications were specified. Background ammonia was initially defined following IWAQM (1998) guidance that recommends a 0.5 ppb background value for forest land that dominates the source and receptor locations of interest. However, at the request of the FLMs the 0.5 ppb background ammonia value in the original analysis (Morris, Jia and Lau, 2006) was updated to 1.0 ppb for this report. Hourly surface ozone based on EPA's Air Quality Stations (AQS) network available from AIRS were used in the analysis. Other CALPUFF parameters were defined using the standard regulatory default settings.

Accounting for Model Uncertainty and Bias

Air quality models represent atmospheric processes using mathematical equations and are imperfect representations of reality so possess inherent uncertainties and limitations. These uncertainties are enhanced in a reduced form model like CALPUFF that uses highly simplified and older representations of atmospheric processes that are designed in part to reduce the computing time of the model. The FLAG (2000) procedures for assessing visibility impacts also have uncertainties and limitations. Thus, in interpreting the CALPUFF modeling results, the uncertainties, limitations and bias in the model and FLAG procedures should be recognized and accounted for.

An initial CALMET/CALPUFF assessment of the impacts of the proposed Project on Class I areas was performed following the FLAG/IWAQM guidance. However, the CALPUFF modeling system has several known deficiencies that produce modeling artifacts and unrealistic concentration and visibility estimates. In addition, the FLAG procedures combined with the CALPUFF model deficiencies can also indicate adverse visibility impacts when none would actually occur. The following is a list of known deficiencies that we attempted to account for in the CALPUFF modeling.

- Overestimation Bias at Long Downwind Distances: The Interagency Workgroup on Air Quality Modeling (IWAQM, 1998) testing and evaluation of the CALPUFF modeling system against real-world atmospheric tracer measurements found that it overestimates maximum concentrations at distances beyond ~200-300 km by a factor of 3-4. EPA notes that since CALPUFF now includes puff splitting then the model is likely applicable to beyond 200 km. This issue is examined for the Jarbidge and Zion Class I areas, that lie ~250 km and ~300 km from the proposed Project, respectively, through visualization of the CALPUFF concentration fields and CALMET wind fields for example high estimated concentration days and performing CALPUFF sensitivity tests with and without puff splitting.

- Mass Consistency Errors: When the CALPUFF puffs encounter stagnant wind locations the puffs slow down and pile up on each other producing unrealistically high concentration impacts. As the CALPUFF dispersion depends on downwind distance, if the puffs essentially stop moving the dispersion also stops. This is unphysical and violates the Second Law of Thermodynamics and if the stagnant winds occur near a Class

I area could produce invalid results. Occurrence of these phenomena was investigated and accounted for in the analysis.

- Chemistry Errors: The CALPUFF sulfate and nitrate formation rates have been shown to be inaccurate and biased (Morris et al., 2003; 2005; 2006). Generally, sulfate is overstated in winter and understated in summer and nitrate is overstated year round. Accounting for the CALPUFF chemistry bias in the Class I impact assessment produces a more reliable and accurate result.

- Visibility Obscuration: Due to deficiencies in the CALPUFF modeling system and IWAQM/FLAG procedures, CALPUFF frequently estimates the highest visibility impacts during periods of intense fog, rain or snow when visibility impairment due to pollutants is not an issue. Recent Class I area assessments have accounted for these obscuration occurrences using various techniques.

- Relative Humidity Errors: For relative humidity levels above 80%, the accuracy of relative humidity (RH) measurements is typically within 5%. This could results in errors in calculated extinction of over a factor of 2. One way to limit the effects of these errors is to use monthly f(RH) adjustment factors (MVISBK=6).

When interpreting the CALPUFF estimated AQ and AQRV impacts at the Class I areas due to emissions from the proposed Project, we examined the frequency, magnitude and duration of the impacts and accounted for model bias and modeling artifacts, such as those listed above, to assess the our best estimate of the Project's effects of AQ and AQRVs in Class I areas.

Organization of Report

Section 2 discusses an overview of the CALMET/CALPUFF modeling approach. Section 3 presents the modeling results due to the Project with comparisons against PSD increments and visibility thresholds and the interpretation of the results. Chapter 4 presents a cumulative SO2 analysis that was requested by the FLMs.

Figure 1-1. Locations of Federally mandated Class I areas in the western US including the Jarbidge Wilderness Area in northeastern Nevada and Zion National Park in southwestern Utah that are the focus of the WPEA Class I area analysis.

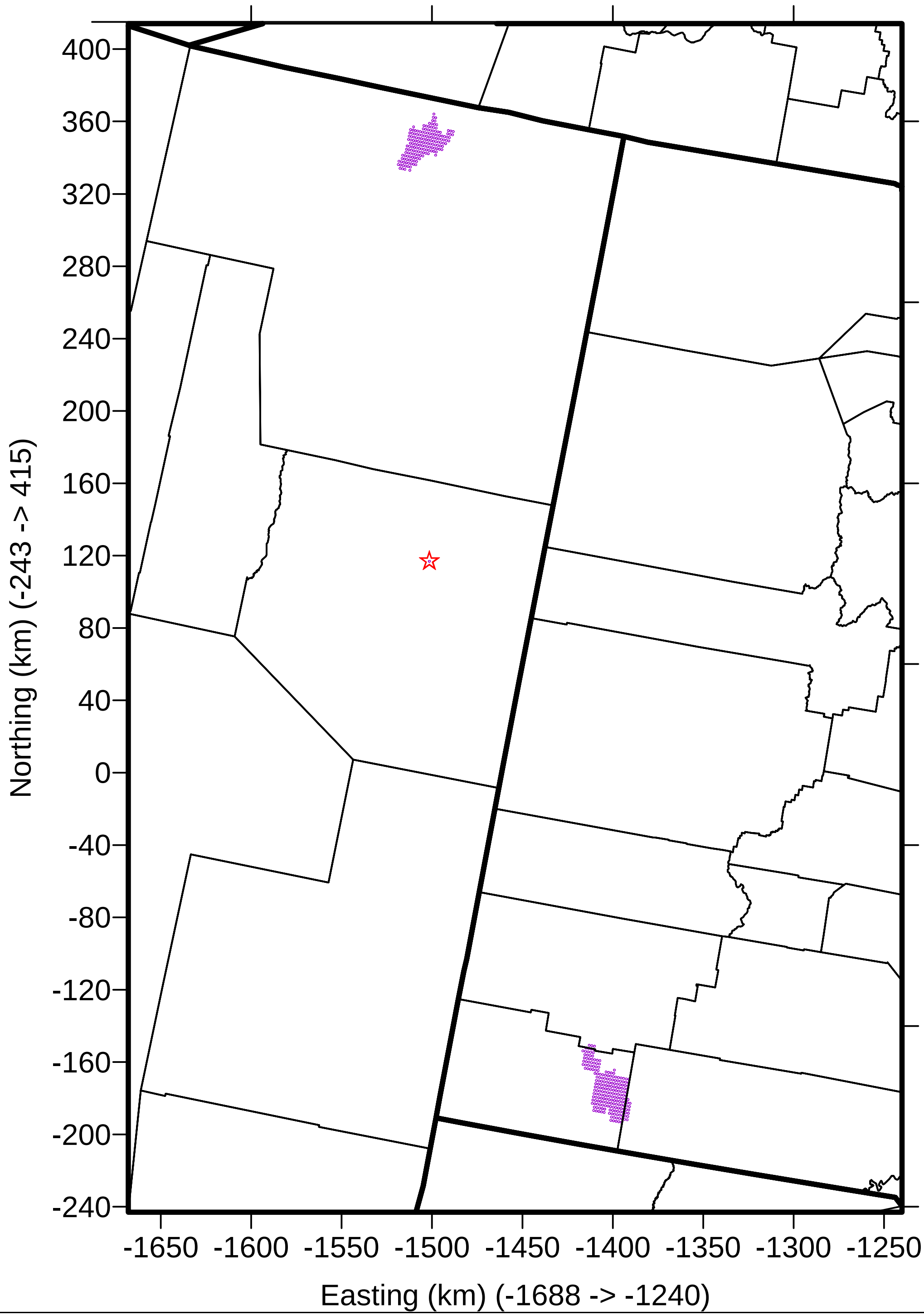

Figure 1-2. Locations of the proposed Project (red star) and the Jarbidge (north) and Zion (south) Class I areas (purple).

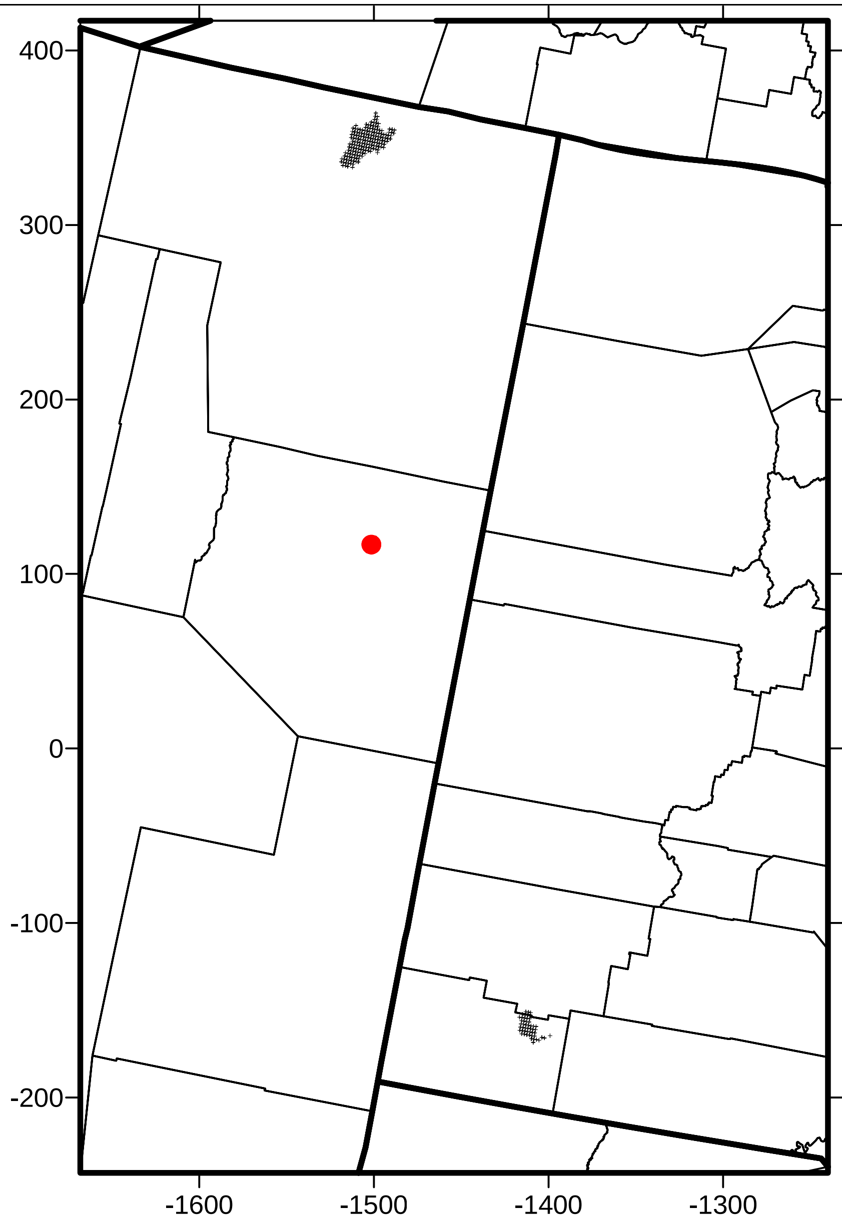

Figure 1-3. Locations of receptors within the Jarbidge and Zion Class I areas that are within 300 km of the proposed Project (red circle).

2.0 CALMET AND CALPUFF INPUTS

Refined CALMET/CALPUFF modeling of the proposed Project was performed using three years of analysis that including the use of Four Dimensional Data Assimilation Mesoscale Meteorological (FDDA-MM) model data as suggested in the applicable guidance documents (EPA, 2003a; FLAG, 2000). The same modeling domain was used in all three applications, although different sources of FDDA-MM data meteorological data were utilized.

For the 1996 application, 36-km MM5 FDDA-MM data are available as input into the CALMET/CALPUFF modeling system using MM5 simulations that were performed for EPA. For the 2001 and 2002 applications, 36-km resolution MM5 FDDA-MM data are available from simulations performed for EPA (used in CAIR/CAMR) and WRAP, respectively.

The procedures used to perform the CALMET meteorological and CALPUFF air quality modeling of the Project for the 1996, 2001 and 2002 annual periods were described in the Modeling Protocol (Morris, Jia and Lau, 2005) and are summarized below.

CALMET/CALPUFF MODELING DOMAIN

Figures 1-2 and 1-3 display the CALMET/CALPUFF modeling domain and the relationship between the proposed location of the Project and the Jarbidge and Zion Class I areas. The modeling domain extends 428 km in the east-west direction and 660 km in the north-south direction. A 1-km grid resolution was used to better resolve the complex terrain in the region resulting in a 428 x 660 horizontal grid for the CALMET meteorological modeling. Sensitivity tests were also conducted using a 4 km resolution grid (107 x 165 horizontal grid). The results using the 4km and 1 km grid were similar, based on better resolution and FLM recommendations a 1 km grid was used in the final analysis. The horizontal grids were defined using a Lambert Conformal Conic (LCC) map projection with a projection origin of 40.0 degrees north latitude and 97.0 degrees west longitude and standard parallels at 33 and 45 degrees. The southwest corner of the CALMET/CALPUFF modeling domain was offset from the LCC origin by –1,668 km west and –243 km south.

Terrain and land use data was reformatted to the 1-km and 4-km resolution CALMET/CALPUFF modeling domain. Example terrain and land use inputs are displayed in Figures 2-1 and 2-2, respectively.

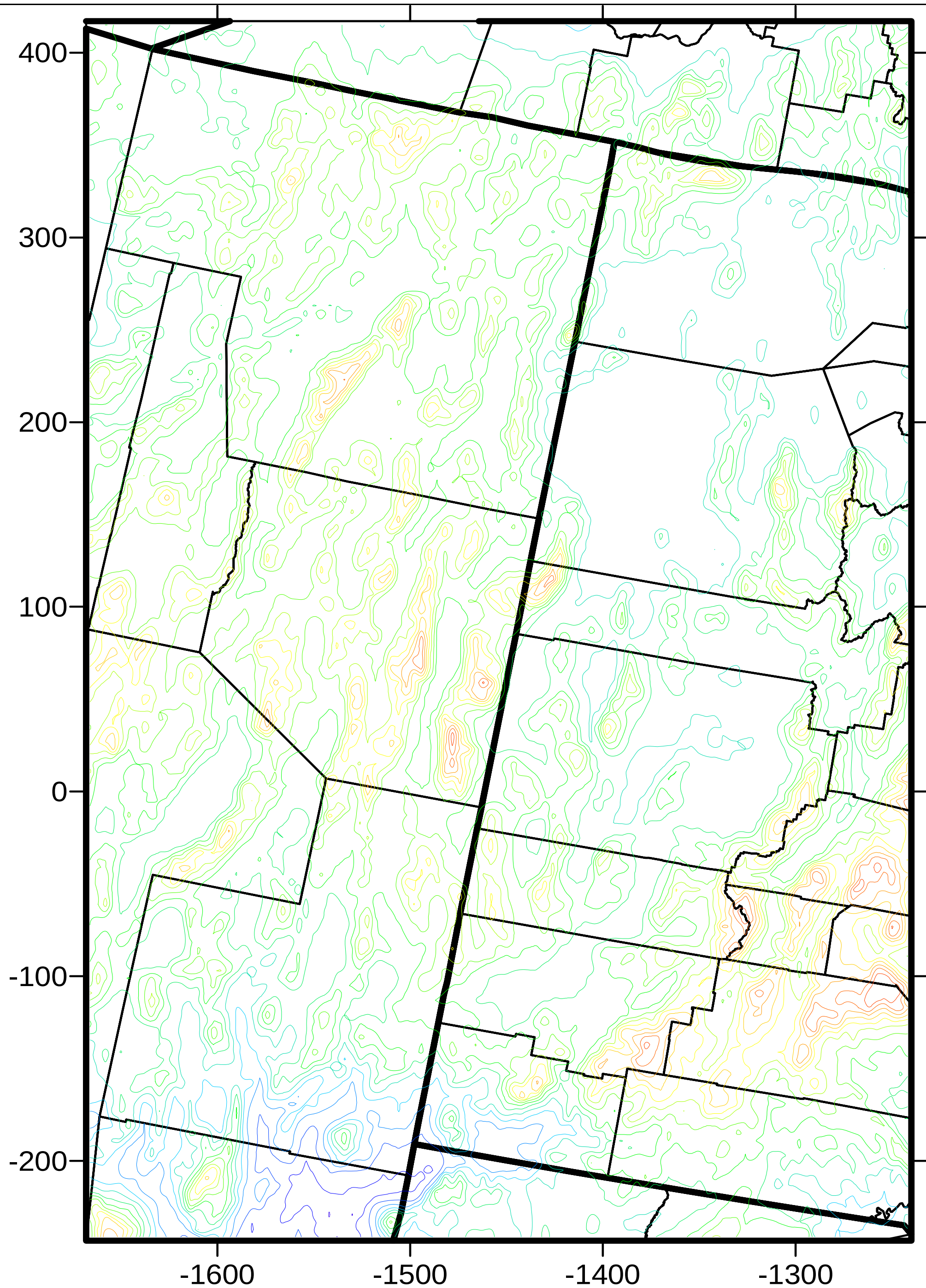

Figure 2-1. Example terrain contours for the modeling domain to be used by CALMET/CALPUFF in the WPEA Class I area analysis (4-km data pictured).

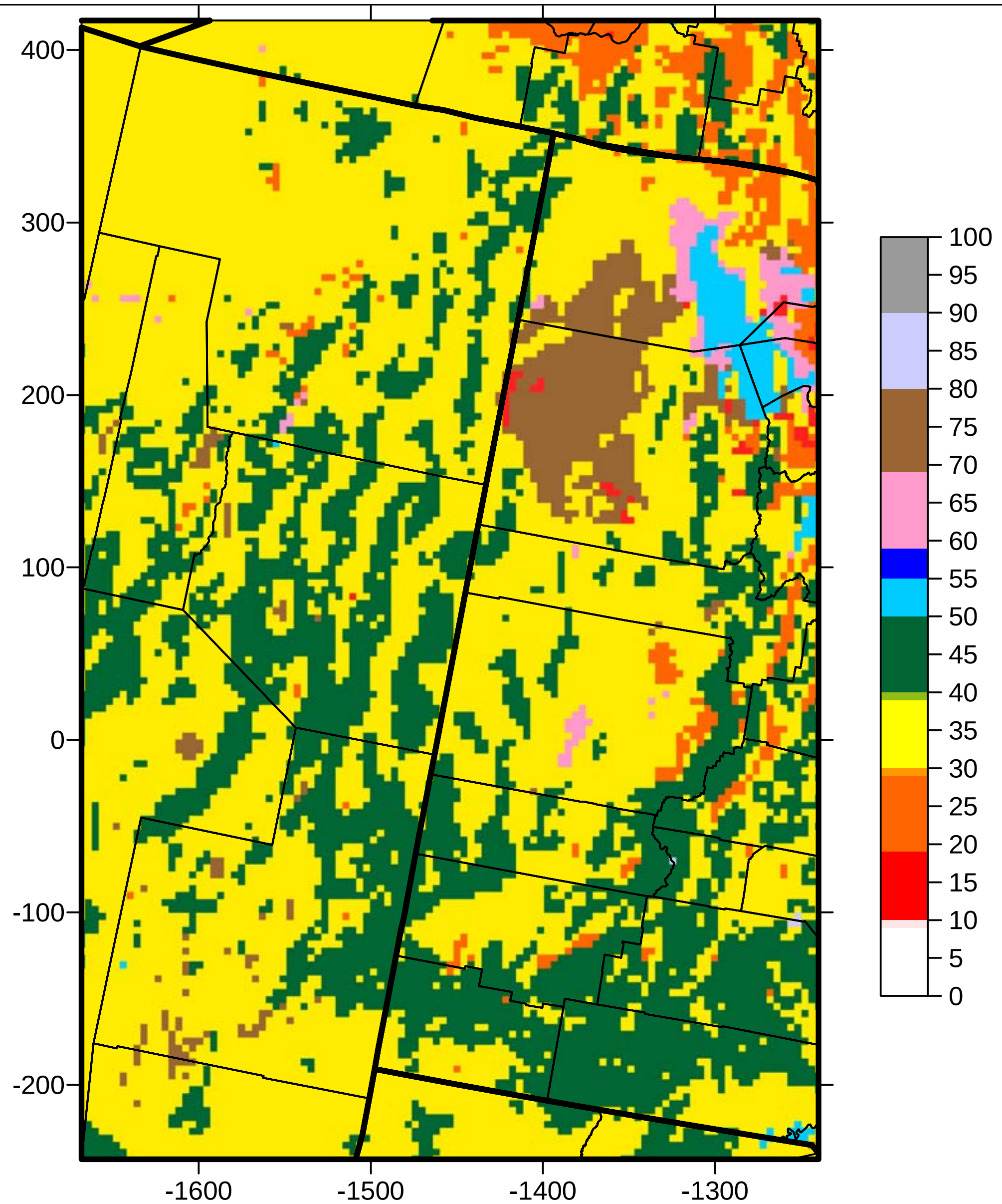

Figure 2-2. Example land use distribution for the modeling domain to be used by CALMET/CALPUFF in the WPEA Class I area analysis [Red (10-20): Urban; Orange (20-30): Ag; Yellow (30-40): Rangeland; Green (40-50): Forest; Blue (50-55): Water; Pink (60-70): Wetland; Brown (70-80) Barren Land; Light Purple (80-90) Tundra; Gray (90-100) Ice/Snow, 4-km data pictured].

METEOROLOGICAL INPUTS

For the 1996, 2001 and 2002 CALMET/CALPUFF application, hourly 36-km MM5 upper-air meteorological "soundings", surface and upper-air meteorological observations for 4 sites and precipitation observations from ~70 sites were provided as inputs. Figure 2-3 displays the locations of the surface and upper-air meteorological observations sites and precipitation sites used in the WPEA CALMET modeling.

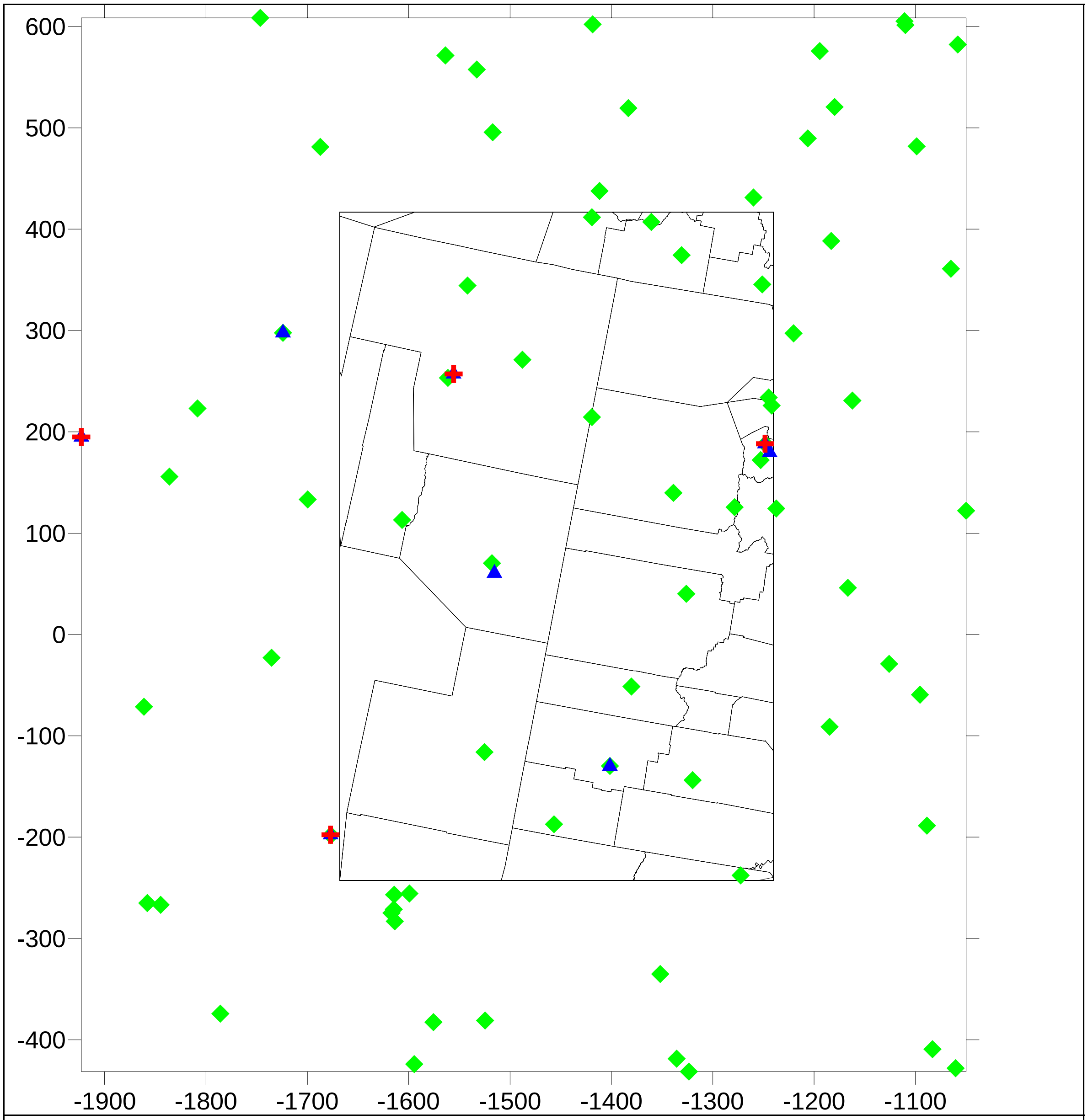

Figure 2-3. Locations of precipitation (green diamonds), surface meteorological (blue triangles) and upper-air meteorological (red crosses) observation sites for the 1996, 2001 and 2002 WPEA CALMET/CALPUFF modeling.

RECEPTORS

Receptors for the Jarbidge Wilderness Area and Zion National Park Class I areas are provided on the NPS website at:

http://www2.nature.nps.gov/air/maps/Receptors/

The receptor location list provided by the NPS results in 174 receptors for the Jarbidge and 51 receptors for the Zion Class I areas, respectively. When evaluating the impacts at the two receptor groups, the maximum impact at any receptor in each group of receptors representing Jarbidge and Zion Class I areas is selected. Only receptors within 300 km of the project were used for the Zion Class I area.

BACKGROUND AIR QUALITY CONCENTRATIONS

The CALPUFF model requires as input background ozone (for the empirical chemistry module) and ammonia (for calculating the $SO_4/NO_3/NH_4$ equilibrium) data.

Background Ozone

Day-specific hourly ozone data from sites within the modeling domain from EPA's AIRS compliance network was used in the CALPUFF refined analysis. Figure 2-4 displays the locations of the ozone monitoring networks used in the 1996, 2001 and 2002 CALPUFF modeling.

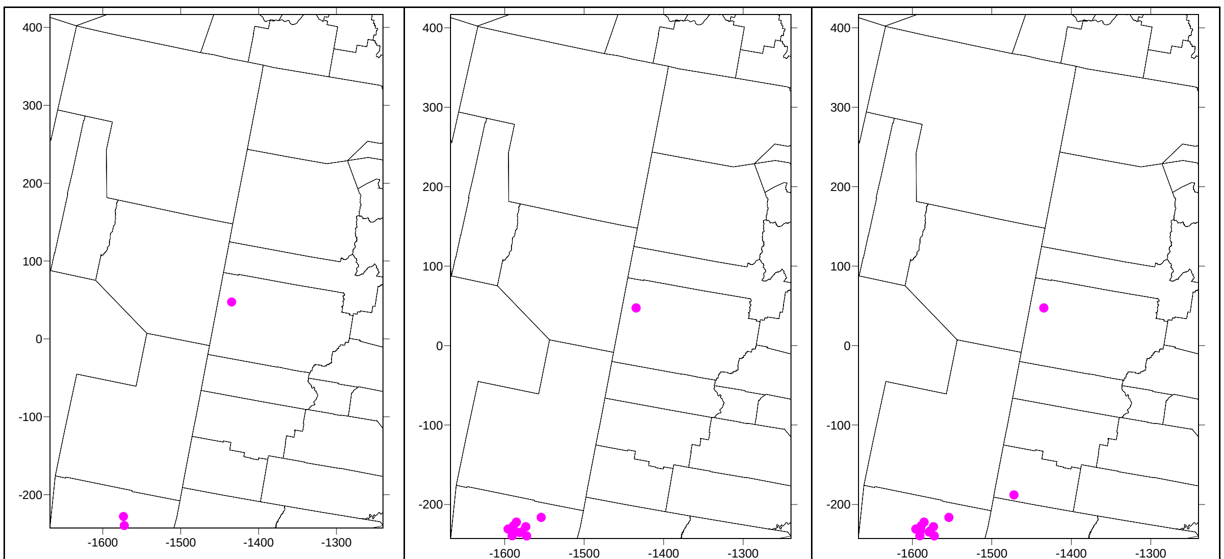

Figure 2-4. Locations of the ozone monitoring sites for the 1996 (left), 2001 (middle) and 2002 (right) WPEA CALMET/CALPUFF modeling.

Background Ammonia

The IWAQM guidance (IWAQM, 1998) contains the following recommended background ammonia concentrations for three categories of land use type as follows:

- 10.0 ppb for grasslands;
- 0.5 ppb for forested lands; and
- 1.0 ppb for arid lands

Figure 2-2 displays the land use distribution across the CALMET/CALPUFF modeling domain. A vast majority of the land use categories in the modeling domain consists of rangeland (yellow), which are the arid desert areas of Nevada and adjacent States, and forestland (green), suggesting a background ammonia value of 0.5-1.0 ppb would be appropriate based on IWAQM guidance. An examination of the source and receptor areas of interest reveals that they lie primarily on forestland (compare Figures 2-1 and 1-2). Thus based on the IWAQM recommendations a 0.5 ppb background ammonia concentration is appropriate and in fact was used in the initial Class I area modeling analysis presented in the June 6, 2006 report (Morris, Jia and Lau, 2006). Comments received from the FLMs stated that they would prefer a 1.0 ppb background ammonia values be used, so a 1.0 ppb background ammonia was used in the results presented in this report.

EMISSIONS

The proposed configuration of the project modeled in this report consisted of three boilers whose emissions would be vented out of two stacks. The modeling was conducted for the two stacks located in close proximity of each other with stack parameters depicted in Table 2-1. Emission rates for sulfur dioxide (SO_2), primary particulate sulfate (SO_4), oxides of nitrogen (NO_X), and particulate matter (PM) emissions of elemental carbon (EC), organic carbon (OC), other fine particulate ($PM_{2.5}$) and coarse particulate (PM_{10}) were used in the CALPUFF modeling analysis. The maximum allowable emission rates used in the WPEA CALPUFF modeling are given in Table 2-2.

Table 2-1. Stack parameters to be used in the WPEA CALPUFF modeling analysis.

X-Coord (LCC)	Y-Coord (LCC)	Height (m)	Elev. (m)	Diameter (m)	Exit Vel (m/s)	Exit Tmp (K)
-1501.423	117.030	182.9	1825.0	9.57	19.81	347.6
-1501.378	117.005	182.9	1825.0	6.77	19.81	347.6

Table 2-2. Emission rates to be used in the WPEA CALPUFF modeling analysis.

	SO_2 (lb/hr)	SO_4 (lb/hr)	NO_X (lb/hr)	$PM_{2.5}$ (lb/hr)	EC (lb/hr)	OC (lb/hr)	PM_{10} (lb/hr)
Stack 1	924.0	36.0	730.0	73.70	2.98	204.0	76.60
Stack 2	462.0	18.0	365.0	36.85	1.49	102.0	38.34

VERSIONS OF CALMET AND CALPUFF

Version 5.5 Level 030402 of CALMET and Version 5.7 Level 030402 of CALPUFF were used in the analysis.

CALMET OPTIONS

The CALMET options used in the WPEA CALMET modeling of 1996, 2001 and 2002 are provided in the Modeling Protocol (Morris, Jia and Lau, 2005) prepared for this study with updates based on comments from the FLMs. A few of the key specifications for the CALMET modeling were:

- Use of LCC projection system at 1 km horizontal resolution;
- Use of 10 vertical layers;
- Observations from 4 surface and 4 upper-air meteorological stations and 73 precipitation stations;
- Extrapolate surface winds aloft using similarity theory (IEXTRP=-4);
- Use of Diagnostic Wind Model (DWM) for generating wind fields (IWFCOD=1); and
- Use of MM5 data as an initial guess field for the DWM (IPROG=14).

CALPUFF OPTIONS

The CALPUFF options used in the WPEA Class I area modeling are provided in the Modeling Protocol (Morris, Jia and Lau, 2005) prepared for this study that were updated based on comments from the FLMs. Some of the key options include the following:

- Use same modeling domain as CALMET;
- Gaussian puff representation;
- MESOPUFF-II transformation rates (MCHEM=1);
- Dry and wet deposition modeled (MDRY=1);
- PG dispersion coefficients for rural areas (MDISP=3);
- 1.0 ppb background ammonia; and
- Technical options must conform to USEPA Long Range Transport (LRT) guidance (MREG=1);

3.0 CALPUFF MODELING RESULTS

In this section we present the CALPUFF estimated air quality (AQ) and air quality related values (AQRVs) impacts due to the Project at Class I areas and compare them against threshold levels that are either not to be exceeded (e.g., PSD increments) or are levels that when exceeded raise concerns and should be evaluated for their significance and reliability (e.g., visibility thresholds). The results are first presented using the basic FLAG (2000) procedures following IWAQM (1998) and EPA (2003a) guidance. We then examine the frequency, magnitude and duration of the impacts accounting for model bias and inaccuracies to assess the likelihood that emissions from the proposed Project would have an adverse AQ or AQRV impact at any Class I area.

THRESHOLD LEVELS

EPA has established Class I area threshold concentration levels for SO_2, NO_2 and PM_{10} concentrations as part of the Prevention of Significant Deterioration (PSD) program. The Federal Land Managers (FLMs) have also developed threshold levels for visibility and sulfur and nitrogen deposition at Class I areas.

PSD Concentrations

As part of EPA's PSD policy, Class I and Class II area concentration increments have been established. The cumulative air quality impacts of all new sources are required to be below the PSD Class I increments. In 1996, EPA published a Federal Register notice of proposed Class I area significant impact level (SIL) thresholds for single projects. These proposed single project SILs are defined as being approximately 4% of the PSD Class I area increment. If a project's impact is below the Class I area single project proposed SIL thresholds, then its impacts are interpreted to be insignificant. If a Project's estimated impact exceeds the Class I area PSD concentration increment, then the Project must perform mitigation to achieve impacts below the PSD increment. If estimated concentrations at Class I areas exceed the proposed single source SIL and are below the Class I area PSD increment, then the frequency magnitude and duration of such impacts are examined along with the reliability and accuracy of the modeling results. Table 3-1 lists the PSD increments and SIL concentration thresholds for Class I areas.

Table 3-1. Class I area single source Significant Impact Levels (SIL) and cumulative sources PSD Increments for Class I areas.

Species and Averaging Time	Class I Area Thresholds	
	Proposed SIL ($\mu g/m^3$)	PSD Increment ($\mu g/m^3$)
SO_2 Annual	0.10	2.00
SO_2 24-Hour	0.20	5.00
SO_2 3-Hour	1.00	25.00
PM10 Annual	0.20	4.00
PM10 24-Hour	0.30	8.00
NO_2 Annual	0.10	2.50

Deposition Impacts

Acid deposition impacts are represented by total sulfur and total nitrogen deposition at the Class I areas. The FLAG procedures require estimation of total sulfur deposition from the CALPUFF-estimated wet and dry SO_2 and sulfate (SO_4) deposition. For nitrogen, wet and dry deposition from all of the nitrogen modeled species are included (NO_x, nitric acid, and particulate nitrate).

The Forest Service (FS) has developed sulfur and deposition thresholds "…below which a land manager can recommend that a permit be issued" (USDA FS, 1989). Although these values vary for different locations, the lowest "green line" sulfur and nitrogen deposition values are 3 kg/ha/yr. More recently, the NPS has posted a document "Guidance on Nitrogen and Sulfur Deposition Analysis Thresholds" on their Website. The NPS Deposition Analysis Thresholds (DATs) for nitrogen and sulfur deposition are as follows:

East DAT: 0.010 kg/ha/yr
West DAT: 0.005 kg/ha/yr

East and west refer to Class I areas east and west of the Mississippi River. The western US DATs are applicable to the Project. Table 3-2 list the sulfur and nitrogen deposition thresholds that the Project deposition estimates will be compared against.

Table 3-2. US Department of Agriculture Forest Service (FS) Sulfur and Nitrogen deposition thresholds and US Department of Interior National Park Service (NPS) Sulfur and Nitrogen Deposition Analysis Thresholds (DATs).

Class I Area	Average Deposition	
	Sulfur (kg-S/ha/yr)	Nitrogen (kg-N/ha/yr)
FS Thresholds	3.0	3.0
NPS DAT	0.005	0.005

Visibility Impacts

The FLAG workgroup recommends procedures for estimating the visibility impacts due to proposed new sources at Class I areas using refined CALMET/CALPUFF modeling (FLAG, 2000). The FLAG visibility metric is the estimated maximum 24-hour change in extinction (Δb_{ext}) over clean natural visibility conditions (Natural Conditions) at the Class I area. The FLAG thresholds for extinction change over natural background are as follows:

- If the source's visibility impact is < 0.4% on all days, the source is considered insignificant and the FLM will not object to the permit.
- If the source's visibility impact is < 5% on all days, the FLM will likely not object to the permit.
- If there are days with the source's visibility impact > 10%, the FLM may object to the permit.

- If there are days in which the source's visibility impact are above 5% the frequency, magnitude and duration of the visibility impacts to make a significance determination.

If a source exceeds a specific threshold at a Class I area, then the frequency, magnitude and duration of the impacts and the reliability and accuracy of the modeling are examined to interpret the modeling results. More recent interpretation of the FLAG procedures for evaluating the visibility impacts estimated by the CALMET/CALPUFF modeling system has allowed the introduction of extenuating circumstances that account for natural obscuration of visibility and modeling artifacts introduced by the CALMET/CALPUFF modeling system and the combination of the two.

The FLAG metric for evaluating visibility impacts at Class I areas used the percent change in the Project's extinction ($b_{project}$) over "Natural Conditions" where the Project's extinction is calculated using the IMPROVE reconstructed mass extinction equation as follows:

$$\mathbf{b_{project} = b_{SO4} + b_{NO3} + b_{OC} + b_{EC} + b_{soil} + b_{coarse}}$$

$$\mathbf{b_{SO4} = 3\,[(NH_4)_2SO_4]f(RH)}$$
$$\mathbf{b_{NO3} = 3\,[NH_4NO_3]f(RH)}$$
$$\mathbf{b_{OC} = 4\,[OC]}$$
$$\mathbf{b_{EC} = 10\,[EC]}$$
$$\mathbf{b_{Soil} = 1\,[Soil]}$$
$$\mathbf{b_{coarse} = 0.6\,[Coarse\ Mass]}$$

Here f(RH) are relative humidity adjustment factors and for refined CALPUFF modeling calculations can be made using day-specific (MVISBK=2) and monthly average (MVISBK=6) f(RH) values. The Natural Conditions used in the Project's visibility assessment are based on guidance from EPA (2003b) and assumes clean conditions with no man-made or weather interference (see Modeling Protocol; Morris, Jia and Lau, 2005). The inclusion of the occurrence of weather influence in the visibility calculations (e.g., fog, rain, snow, etc.) has been allowed in Class I area visibility assessments.

BEST ESTIMATE OF WPEA CLASS I AREA IMPACTS

The concentrations at the Class I area due to the Project's emissions are estimated to be well below (factor of 10 or more) the Class I area PSD concentration increments. The proposed Class I area single-source SIL for 3-hour and 24-hour SO2 concentrations is estimated to be exceeded for all three years at Jarbidge and the 3-hour SO2 SIL is estimated to be exceeded at Zion for just 2001. A cumulative SO2 emissions PSD increment consumption analysis was performed (see Section 4) that demonstrated that the cumulative impact from all SO2 increment consuming sources would not come close to exceeding the Class I area PSD SO2 concentration increments.

Using monthly average relative humidity adjustment factors [f(RH)] and EPA's default Natural Conditions reduces the number of days exceeding the 5% and 10% visibility thresholds.

Additional beyond FLAG analysis was performed that indicated the following:

1. The IWAQM (1998) finding that CALPUFF overestimates maximum concentrations by a factor of 3-4 at downwind distances beyond 200-300 km is applicable to this application where visualization of the wind fields on the maximum impacts days clearly indicates the presence of wind shear that should enhance the plume dispersion that is not accounted for adequately by CALPUFF; and
2. The CALPUFF chemistry simplification has been shown to overstate the visibility impacts by a factor of approximately 5 for a source located in western U.S. during winter conditions.

The CALPUFF underestimation of dispersion at longer downwind distances and resultant over-prediction of maximum estimated concentrations by a factor of 3-4 (IWAQM, 1998) and overestimation of visibility due to bias in the CALPUFF chemistry algorithms by a factor of approximately 5 (Morris, Lau, Koo and Yarwood, 2006) are independent of each other so should be combined. Accounting for these factors suggests that there would be no days at Zion above the 5% visibility threshold and likely no days, but at most, just a few days at Jarbidge above the 5% visibility threshold.

Proposed new FLAG guidance uses the 98th percentile visibility impact for comparison against the 5% and 10% change in extinction over Natural Conditions thresholds. With 3 years of modeling, the 98th percentile would be the 22nd highest day. The 98th percentile visibility impact due to the Project at Jarbridge and Zion are 7.63% and 2.98%, with the JARB 98th percentile value slightly above the 5% threshold. However, the 33rd highest value at JARB, which represents the 97th percentile, is below the 5% threshold (4.48%) that when combined with the conservatisms in the modeling suggests the Project would not have an adverse visibility impact at any Class I area.

The CALPUFF-estimated annual total Sulfur (S) and Nitrogen (N) deposition due to the Project's emissions at the Jarbidge or Zion Class I areas vary from 0.02% to 0.3% of the Forest Service "greenline" threshold of adverse impact (3.0 kg/ha/yr) for the three years modeled. The estimated nitrogen deposition is always below the stringent NPS western US DAT (0.005 kg/ha/yr) at the two Class I areas. The estimated sulfur deposition is between the NPS western (0.005 kg/ha/yr) and eastern (0.010 kg/ha/yr) DAT at Zion for all three years and at Jarbidge for one year (1996). For 2001 and 2002, the sulfur deposition at Jarbidge (0.017 kg/ha/yr) is slightly above the eastern DAT (0.010 kg/ha/yr).

CALPUFF CLASS I AREA IMPACTS FOLLOWING FLAG GUIDANCE

The CALPUFF modeling system and FLAG procedures for estimating visibility contain modeling artifacts and bias that affect its estimated concentrations and visibility impacts at Class I areas. Some procedures have been developed to limit the effects of model bias (e.g. restricting analysis to source-receptor distances of less than 200 km; IWAQM, 1998) and modeling artifacts (e.g., including natural obscuration in the visibility background). However, the application of the CALPUFF modeling system following modeling guidance (IWAQM, 1998; FLAG, 2000; EPA, 2003a) is an important screening tool in the Class I area analysis as it allows the FLMs to evaluate new Projects using consistent modeling approaches. In this section we first present the CALPUFF modeling results strictly following the FLAG/IWAQM guidance (FLAG, 2000; IWAQM, 1998) without accounting for the model inaccuracies and modeling artifacts. We then examine the frequency, magnitude and duration of the CALPUFF-estimated Class I area AQ and AQRV impacts due to the Project accounting for model bias and artifacts to provide a more reliable estimate of the potential AQ and AQRV impacts from the proposed Project.

The basic CALPUFF/CALMET model configuration used a 1 km resolution grid, with puff splitting (with NSPLIT=2) and a 1 ppb background ammonia value. Model sensitivity tests were also run with and without puff splitting and with a 4 km grid resolution. Other model input options and configurations are discussed in Section 2 with details found in the Modeling Protocol (Morris, Jia and Lau, 2005).

PSD Pollutant Concentrations

Table 3-3 lists the CALPUFF estimated PSD pollutant concentrations at the Jarbidge and Zion Class I areas and compares them with the PSD Class I increments and proposed single source SIL. For annual averages, the highest impact at any receptor in each Class I area is listed in Table 3-3, whereas for shorter-term averaging periods other than annual (i.e., 3-hour and 24-hour), the highest second highest value at any receptor is listed. The CALPUFF-estimated concentration impacts due to the Project are always well below (over a factor of ten) the Class I area PSD concentration increments. The Project's estimated concentrations at the Class I areas are also below the proposed Class I area single-source SIL for most PSD pollutants and averaging times. The exceptions are for estimated 3-hour and 24-hour average SO_2 concentrations that slightly exceed the proposed SIL at the Jarbidge Class I area; and a 3-hour SO_2 estimated concentration at Zion for 2001 that just barely (1.11 $\mu g/m^3$) exceeds the Class I area 3-hour SO_2 SIL (1.00 $\mu g/m^3$).

Table 3-3. CALPUFF estimated PSD pollutant concentrations impacts at Class I areas for the WPEA Project using 1 km CALMET meteorological fields and with puff splitting.

Species and Averaging Time	Class I Area Thresholds		CALPUFF at Class I Areas	
	Proposed SIL ($\mu g/m^3$)	PSD Increment ($\mu g/m^3$)	Jarbidge	Zion
1996				
SO_2 Annual	0.10	2.00	0.0039	0.0065
SO_2 24-Hour*	0.20	5.00	**0.2361**	0.1822
SO_2 3-Hour*	1.00	25.00	**1.1738**	0.6412
PM10 Annual	0.20	4.00	0.0004	0.0005
PM10 24-Hour*	0.30	8.00	0.0122	0.0150
NO_2 Annual	0.10	2.50	0.0009	0.0020
2001				
SO_2 Annual	0.10	2.00	0.0151	0.0059
SO_2 24-Hour*	0.20	5.00	**0.4355**	0.1202
SO_2 3-Hour*	1.00	25.00	**1.4626**	**1.1127**
PM10 Annual	0.20	4.00	0.0014	0.0004
PM10 24-Hour*	0.30	8.00	0.0373	0.0101
NO_2 Annual	0.10	2.50	0.0036	0.0014
2002				
SO_2 Annual	0.10	2.00	0.0117	0.0054
SO_2 24-Hour*	0.20	5.00	**0.3732**	0.1122
SO_2 3-Hour*	1.00	25.00	**1.7034**	0.6286
PM10 Annual	0.20	4.00	0.0011	0.0005
PM10 24-Hour*	0.30	8.00	0.0387	0.0099
NO_2 Annual	0.10	2.50	0.0038	0.0013

* Highest second high at any monitor in the Class I area.

If estimated exceedances of the proposed single-source SIL occur, then the frequency, magnitude and duration of the impacts are examined to determine their significance. Table 3-4 lists CALPUFF-estimated 3-hour and 24-hour average SO_2 concentrations at any receptor in the Jarbidge Class I area during 1996, 2001 and 2002 that exceed the 1.0 or 0.2 $\mu g/m^3$ SIL 3-hour or 24-hour SO2 threshold, respectively. The CALPUFF results for the Project estimate that the proposed SIL for 3-hour SO_2 concentrations is only exceeded for 19 3-hour periods during the three years of modeling. That is, the very stringent proposed SIL for 3-hour SO_2 is only estimated to be exceeded on ~0.2% of the time, a rare event indeed. Given the inherent conservatisms in the CALPUFF model, especially at these far downwind distances (factor of 3-4), the proposed Project would likely never result in 3-hour SO_2 concentrations above the proposed SIL. Similar infrequent results are seen for the estimated 24-hour SO_2 concentrations at Jarbidge due to the Project.

Table 3-4. Highest 3-hour and 24-hour average CALPUFF estimated SO2 concentrations with Julian day and ending hour (in parenthesis) at the Jarbidge Class I area during 1996, 2001 and 2003 for the WPEA Project using 1 km CALMET meteorological fields with puff splitting.

Rank	1996 (μg/m^3)	2001 (μg/m^3)	2002 (μg/m^3)
3-Hour SO2			
Proposed SIL	*1.00*	*1.00*	*1.00*
1st	1.41 (035, 0500)	1.58 (310, 0500)	1.75 (325, 0800)
2nd	1.17 (035, 0800)	1.46 (270, 0800)	1.73 (342, 2300)
3rd	0.60 (304, 0800)	1.36 (063, 0800)	1.70 (325, 0800)
4th	0.51 (106, 1700)	1.34 (063, 0500)	1.50 (259, 0500)
5th		1.33 (316, 1700)	1.48 (325, 0500)
		1.20 (316, 1400)	1.45 (325, 0800)
		1.06 (268, 0800)	1.29 (259, 0500)
		1.04 (063, 1100)	1.00 (188, 0800)
		1.02 (310, 0200)	0.93 (325, 1100)
24-Hour SO2			
Proposed SIL	*0.20*	*0.20*	*0.20*
1st	0.48 (035, 2300)	0.56 (063, 2300)	0.57 (325, 2300)
2nd	0.24 (304, 2300)	0.44 (316, 2300)	0.38 (002, 2300)
3rd	0.12 (106, 2300)	0.34 (310, 2300)	0.37 (334, 2300)
4th	0.07 (178, 2300)	0.29 (309, 2300)	0.32 (047, 2300)
5th		0.27 (315, 2300)	0.29 (259, 2300)
		0.26 (270, 2300)	0.27 (342, 2300)
		0.18 (268, 2300)	0.25 (342, 2300)
			0.20 (343, 2300)

<u>Conservatisms of the CALPUFF Modeling System</u>

Regarding the inherent conservatisms and overestimation bias in the CALPUFF modeling system. The Interagency Workgroup on Air Quality Modeling (IWAQM, 1998) did extensive testing of the CALPUFF modeling system for inert compounds, including the comparison against real-world tracer measurements, and made the following recommendations and conclusions regarding the accuracy and bias of the CALPUFF modeling system:

> "IWAQM recommends use of CALPUFF for transport distances of 200 km and less." (IWAQM, 1998, pg. 18).
>
> "The IWAQM concludes that CALPUFF can be recommended as providing unbiased estimates of concentration impacts for transport distances of order 200 km or less and for transport times of order 12 hours or less. For larger transport times and distances, our experience thus far is that CALPUFF tends to underestimate the horizontal extent of the dispersion and hence tends to overestimate surface-level concentrations maxima." (IWAQM, 1998, pg. D-12).
>
> "The CAPTEX comparisons, which involved comparisons at receptors that were 300 km to 1000 km from the release, suggest that CALPUFF tends to overestimate surface concentrations by a factor of 3 to 4." (IWAQM, 1998, pg. 18).

The Jarbidge Class I area is approximately 250 km from the proposed Project, with the Zion Class I area being even further (~300 km). At these distances IWAQM found the model greatly overstates the surface concentrations with the downwind distances approaching those where comparisons of the CALPUFF modeling system against real-world CAPTEX tracer observations found the overstatement to be on the order of a factor of 3 to 4.

However, the IWAQM experiments were performed before CALPUFF implemented puff splitting. EPA's 2003 Air Quality Modeling Guidelines argues that the use of puff splitting would extend the downwind distance applicability of the CALPUFF model and states:

> "enhancements were made to the CALPUFF that allows puffs to be split both horizontally (to address wind direction shear) and vertically (to address spatial variation in the meteorological conditions). These enhancements likely will extend the systems ability to treat transport and dispersion beyond 300 km." (EPA 2003a, Air Quality Modeling Guidelines; Federal Register Vol. 68, No. 72, April 15, 2003; 40 CFR Part 51).

Although EPA's modeling guidelines postulates that use of puff splitting would "likely" extend the downwind applicability of CALPUFF beyond 200 km, not supporting documentation has ever been provided. In fact, tests running CALPUFF side-by-side with and without puff splitting indicate very little different in predicted maximum concentrations, but large differences I the run time of the model. This issue was investigated with the proposed Project CALMET/CALPUFF modeling database.

<u>Effects of Puff Splitting</u>: Although the EPA modeling guidelines suggest that puff splitting should eliminate the large overestimation bias found by IWAQM at distances greater than 200 km, the IWAQM or similar tests of model reliability at distances further than 200 km to support these statements were never reported on. To test EPA's statements that the use of puff splitting in CALPUFF would eliminate the over-prediction bias seen by IWAQM at longer downwind distance, we reran the CALPUFF modeling system for the Project and the three years (1996, 2001 and 2002) using identical options in CALPUFF, only turning off the puff splitting. The results for the CALPUFF-estimated highest second high 3-hour and 24-hour SO_2 concentrations at the Jarbidge Class I area with and without using puff splitting are shown in Table 3-5. Also shown in Table 3-5 is the percent difference of the estimated highest second high concentrations at Jarbidge, where positive differences indicates the puff spitting produces higher concentrations than without puff splitting and negative percent differences indicates that puff splitting produces lower concentrations than without puff splitting. Rather than alleviating the CALPUFF factor of 3-4 overestimation bias found by the IWAQM tests at distances greater than 200-300 km as suggested by EPA in their 2003 Modeling Guidelines, puff splitting in CALPUFF instead has from essentially no effect to exacerbating the CALPUFF overestimation bias found by IWAQM when puff splitting wasn't used. Thus, at least for the conditions of this Project and Class I areas studied and the three years of modeling data, the CALPUFF overestimation bias identified by the IWAQM analysis is not mitigated by puff splitting.

Table 3-5. Comparison of the highest second high CALPUFF-estimated 3-hour and 24-hour SO_2 concentrations at the Jarbidge Class I area from the Project's emissions running CALPUFF with and without using puff splitting.

Rank	With Puff Splitting ($\mu g/m^3$)	Without Puff Splitting ($\mu g/m^3$)	Difference with - w/o (%)
3-Hour SO2			
1996	1.1738	1.1404	+2.9%
2001	1.4626	1.3363	+9.5%
2002	1.7034	1.6714	+1.9%
24-Hour SO2			
1996	0.2361	0.2311	-2.1%
2001	0.4355	0.4390	-0.8%
2002	0.3732	0.3585	+4.1%

<u>CALPUFF Failure to Account for Wind Shear Results in Overestimation Bias</u>: Figures 3-1 and 3-2 display the CALPUFF-estimated hourly SO_2 concentrations due to the Project on February 4, 1996 (Julian day 035) and December 6, 2002 (Julian day 340) with superimposed wind fields at various heights above ground level (AGL). These are two of the worst case modeled days for short-term SO_2 concentrations. These figures clearly show that CALPUFF's assumption of puff coherency, failure to adequately account for vertical and horizontal wind shear in its dispersion and use of a single wind to advect the puff downwind results in a large overestimation of the downwind estimated concentration impacts due to the Project's emissions. Figure 3-1 displays the CALPUFF-estimated ground-level SO_2 concentrations at 00:00, 06:00, 12:00 and 18:00 on February 4, 1996 with superimposed wind fields at heights of 10m, 75m, 300m and 1250m AGL. The 10 m wind fields around the Project and JARB are from the east with sometimes a northerly component (Figure 3-1a); yet the Project's plume is being advected north, even at the surface where winds are clearly not from the south as required to obtain northerly transport. At 75 m AGL the wind fields at the Project and near JARB are from the east at 00:00 and 06:00, from the northeast at 12:00 and from the north at 18:00 (Figure 3-1b) which should blow the Project's emissions away from the Jarbidge Class I area. However, again the Project's plume is advected to the north using a southerly wind and thus fails to account for the easterly and northerly winds at 10 m and 75 m that would transport the emissions from the Project plume west away from JARB. AT 300 m AGL, the wind fields and Project's plume are more consistent. This must be the vertical layer where the Project's plume centerline resides and therefore is used to transport the entire column of air that contain the project's emissions northwards (Figure 3-1c), even though the winds below 300 m AGL clearly have components that would transport emissions from the Project west and south away from JARB. Finally, Figure 3-1d displays the wind fields at 1250 m AGL that are generally from the southwest which would transport the Project's plume to the east of JARB. Thus, CALPUFF's invalid assumption that the Project's puff is a coherent air parcel whose column of emissions is transported using just one wind at the plume centerline is invalid on this day and leads to greatly overstated concentration and visibility impacts at the Jarbidge Class I area. Figure 3-1 clearly shows that the CALPUFF calculated SO_2 impacts at Jarbidge Class I area on February 4, 1996 are greatly overstatements due to deficiencies of the CALPUFF treatment of vertical wind shear and when accounting for wind shear the actual impacts would be greatly below the proposed SIL for Class I areas. The understatement of plume expansion in CALPUFF at longer downwind distances is the reason given by IWAQM for the factor of 3-4 overstatement bias (IWAQM, 1998), clearly the failure of CALPUFF to adequately treat vertical wind shear as seen in the February 4, 1996 modeling results is one

reason for the overestimation bias found by IWAQM. Figure 3-2 displays similar plots to Figure 3-1 only for December 6, 2002, another day the CALPUFF calculated high SO_2 concentrations at JARB. Although the vertical wind shear is not as pronounced as seen on February 4, 1996, there is lots of vertical wind shear on December 6, 2002 that is not accounted for in the CALPUFF estimate of the Project's plume transport and dispersion resulting in overstated impacts at the JARB receptor area on this day also.

<u>CALPUFF Overestimation Bias When Stagnation is Encountered</u>: An added complication with the December 6, 2002 wind fields is an area of stagnant winds over the JARB Class I area (Figure 3-2). When CALPUFF puffs are advected north and encounter stagnant winds over JARB, they stop moving. Because CALPUFF dispersion is based on downwind distance, if a puff stops moving dispersion stops also. As more puffs are advected north and encounter the stagnant winds over JARB they pile up on each other, which is physically impossible and a violation of the second law of thermodynamics (energy spontaneously tends to flow only from being concentrated in one place to becoming diffused or dispersed and spread out). Thus, the CALPUFF-estimated SO_2 impacts are overstated as they fail to account for wind shear in the transport and dispersion and have other unphysical qualities that lead to overestimates.

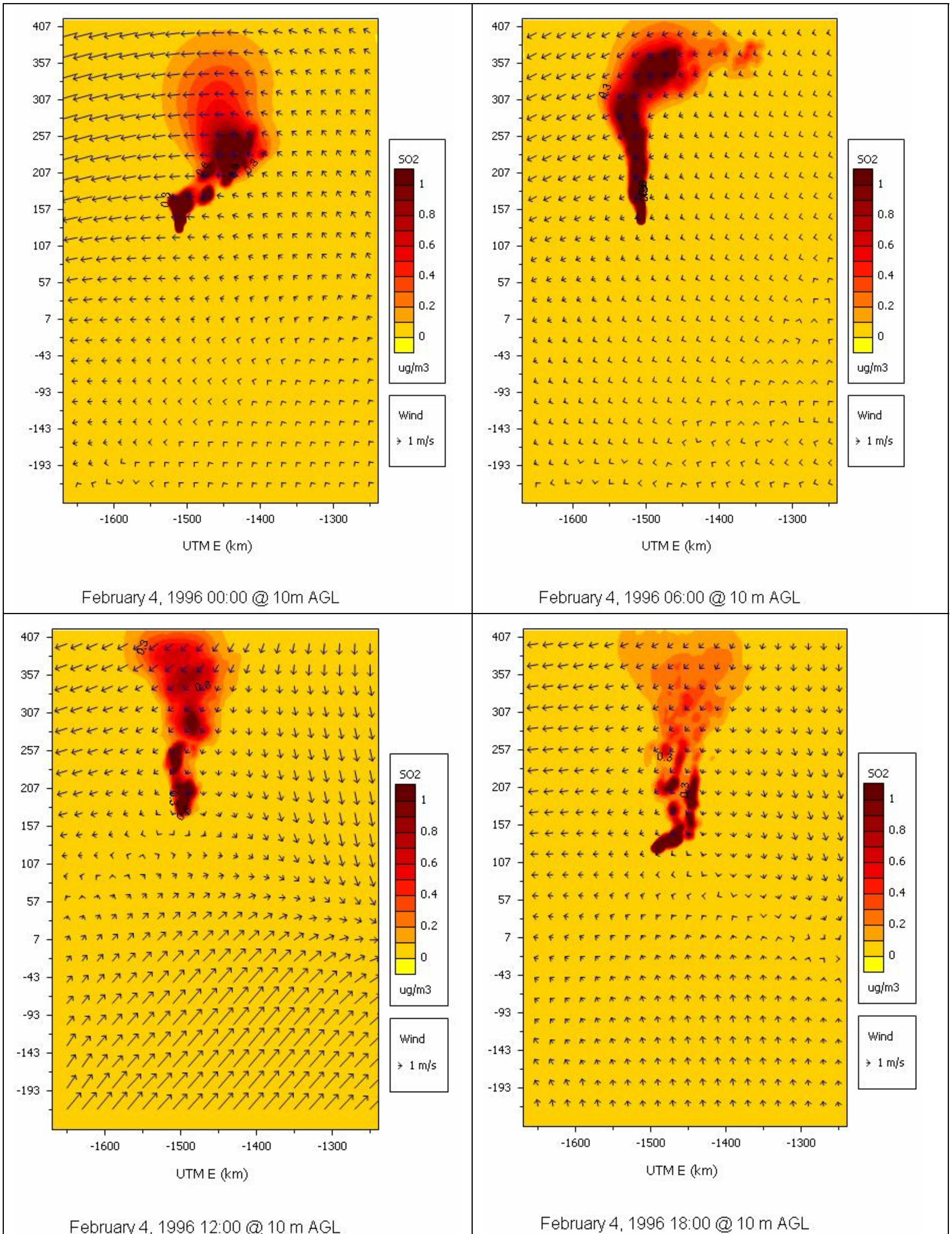

Figure 3-1a. CALPUFF-estimated hourly SO_2 concentrations (µg/m^3) at 00:00, 06:00, 12:00 and 18:00 on February 4, 1996 shown with 10 meters above ground level (AGL) wind fields (m/s).

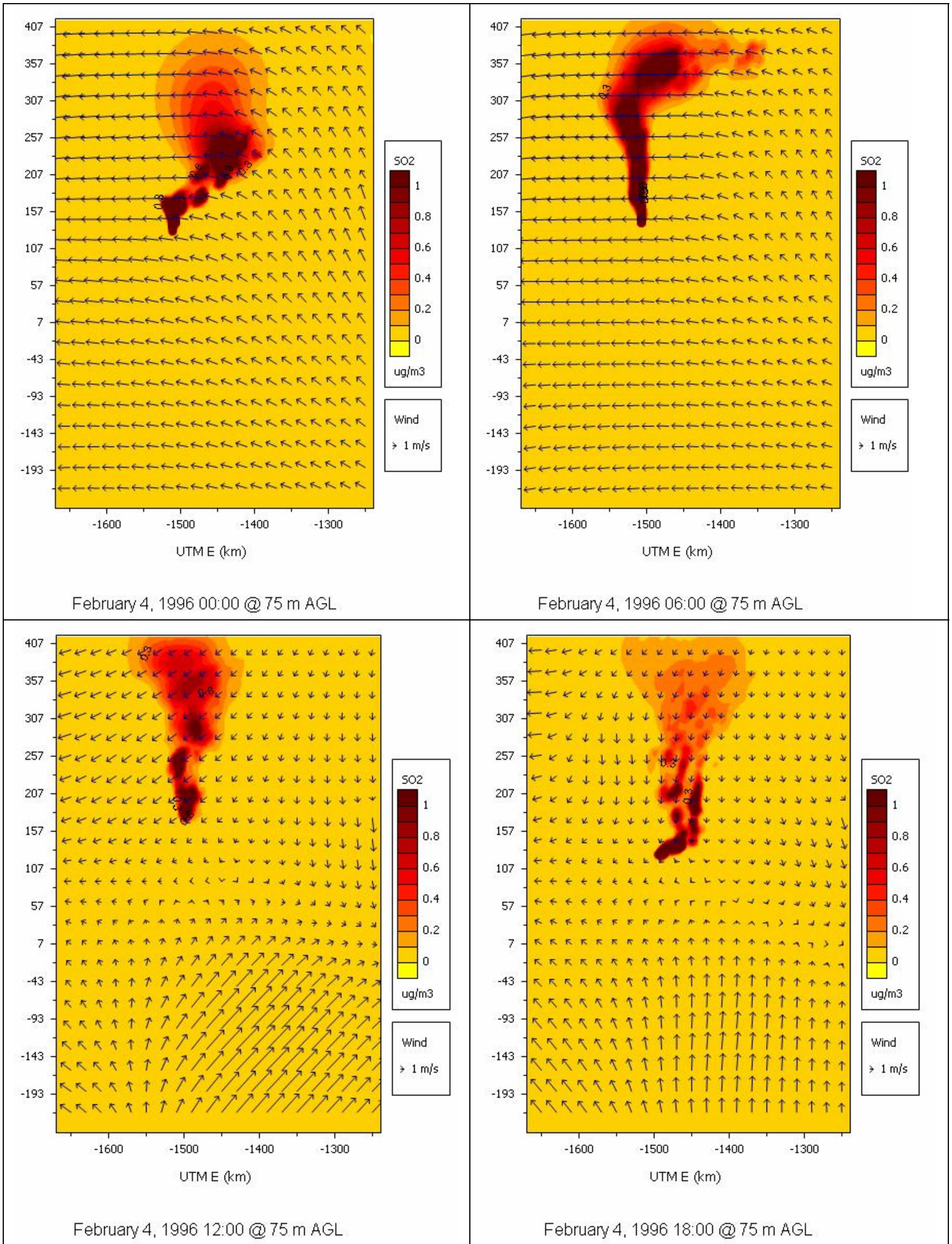

Figure 3-1b. CALPUFF-estimated hourly SO_2 concentrations (µg/m^3) at 00:00, 06:00, 12:00 and 18:00 on February 4, 1996 shown with 75 meters above ground level (AGL) wind fields (m/s).

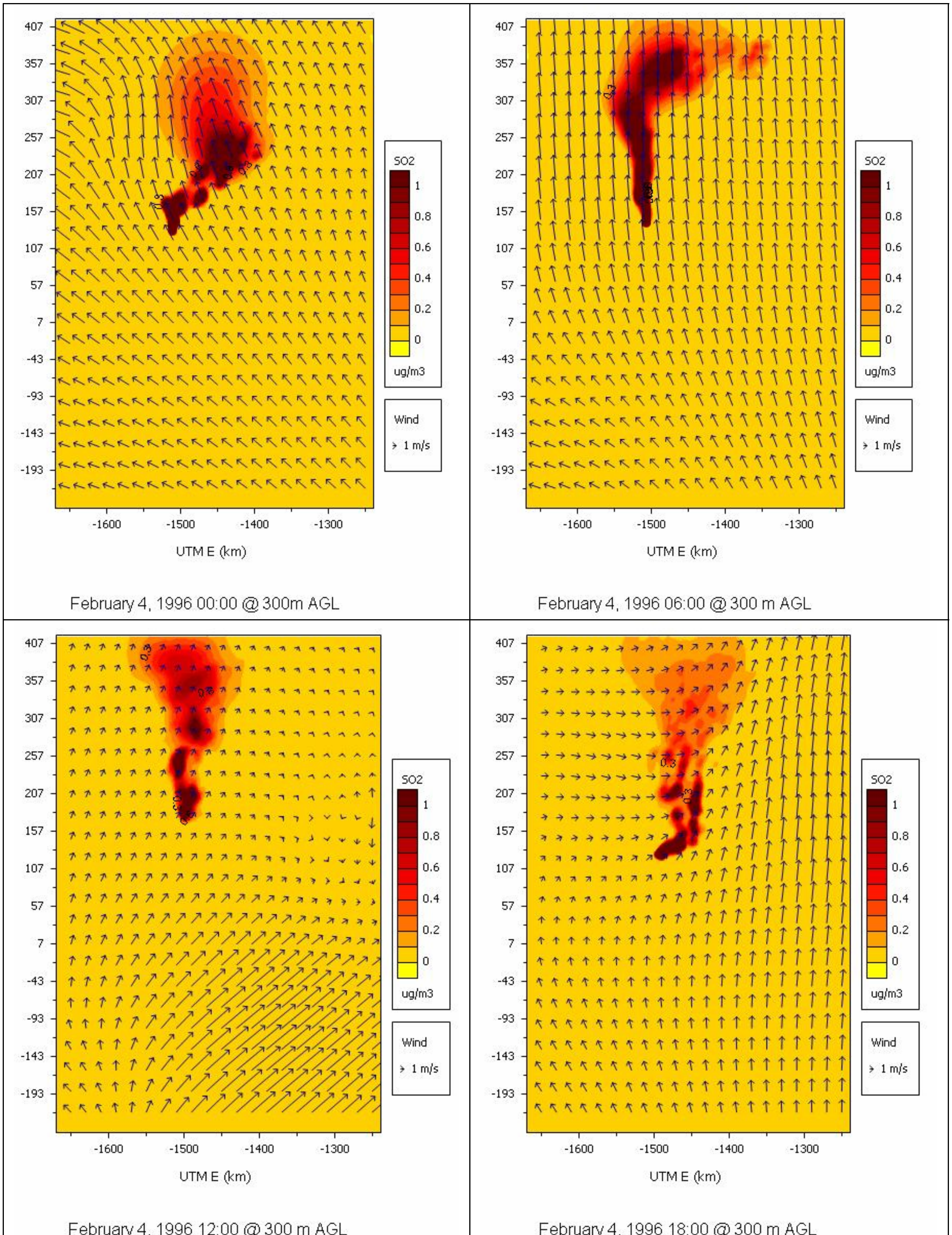

Figure 3-1c. CALPUFF-estimated hourly SO_2 concentrations ($\mu g/m^3$) at 00:00, 06:00, 12:00 and 18:00 on February 4, 1996 shown with 300 meters above ground level (AGL) wind fields (m/s).

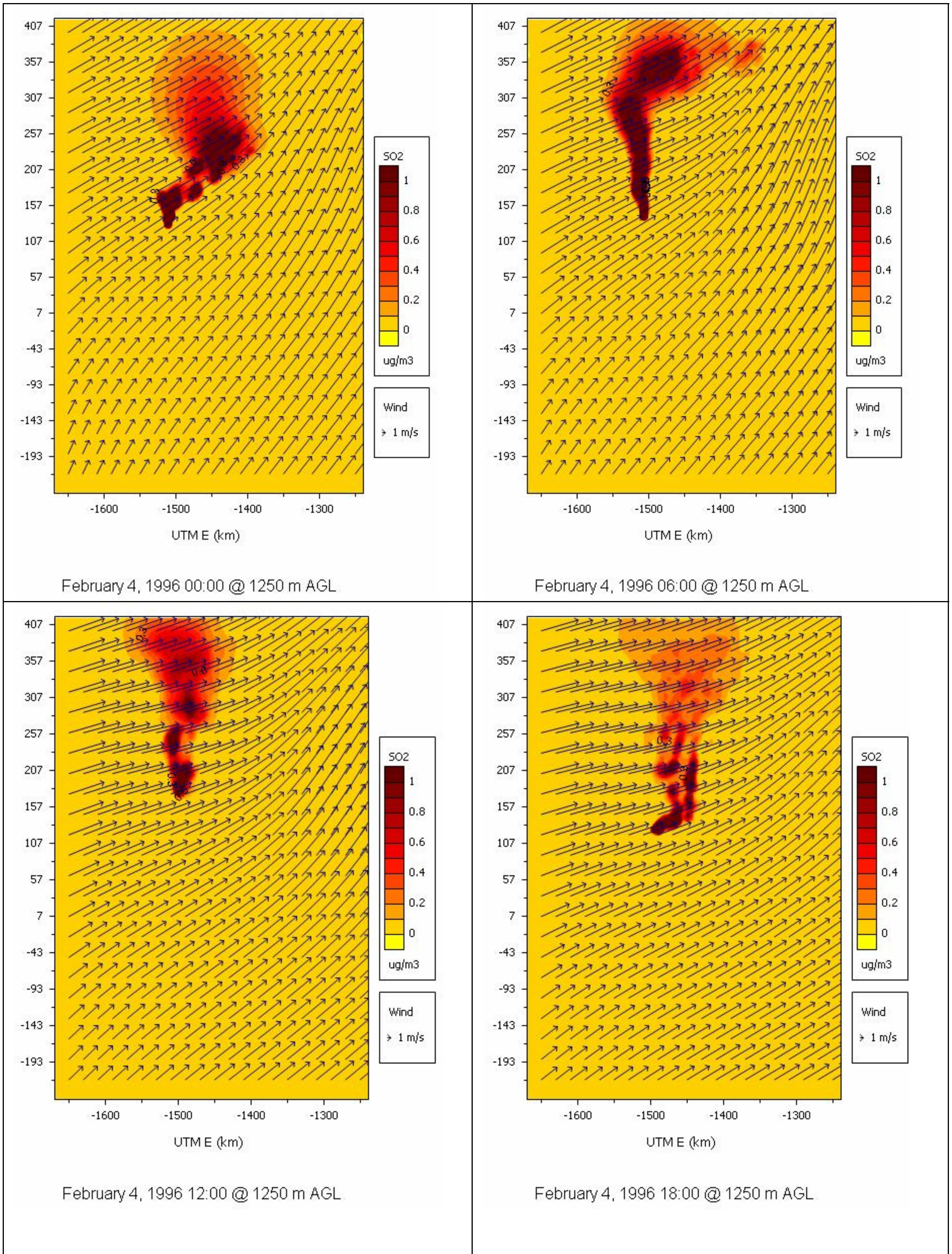

Figure 3-1d. CALPUFF-estimated hourly SO_2 concentrations ($\mu g/m^3$) at 00:00, 06:00, 12:00 and 18:00 on February 4, 1996 shown with 1250 meters above ground level (AGL) wind fields (m/s).

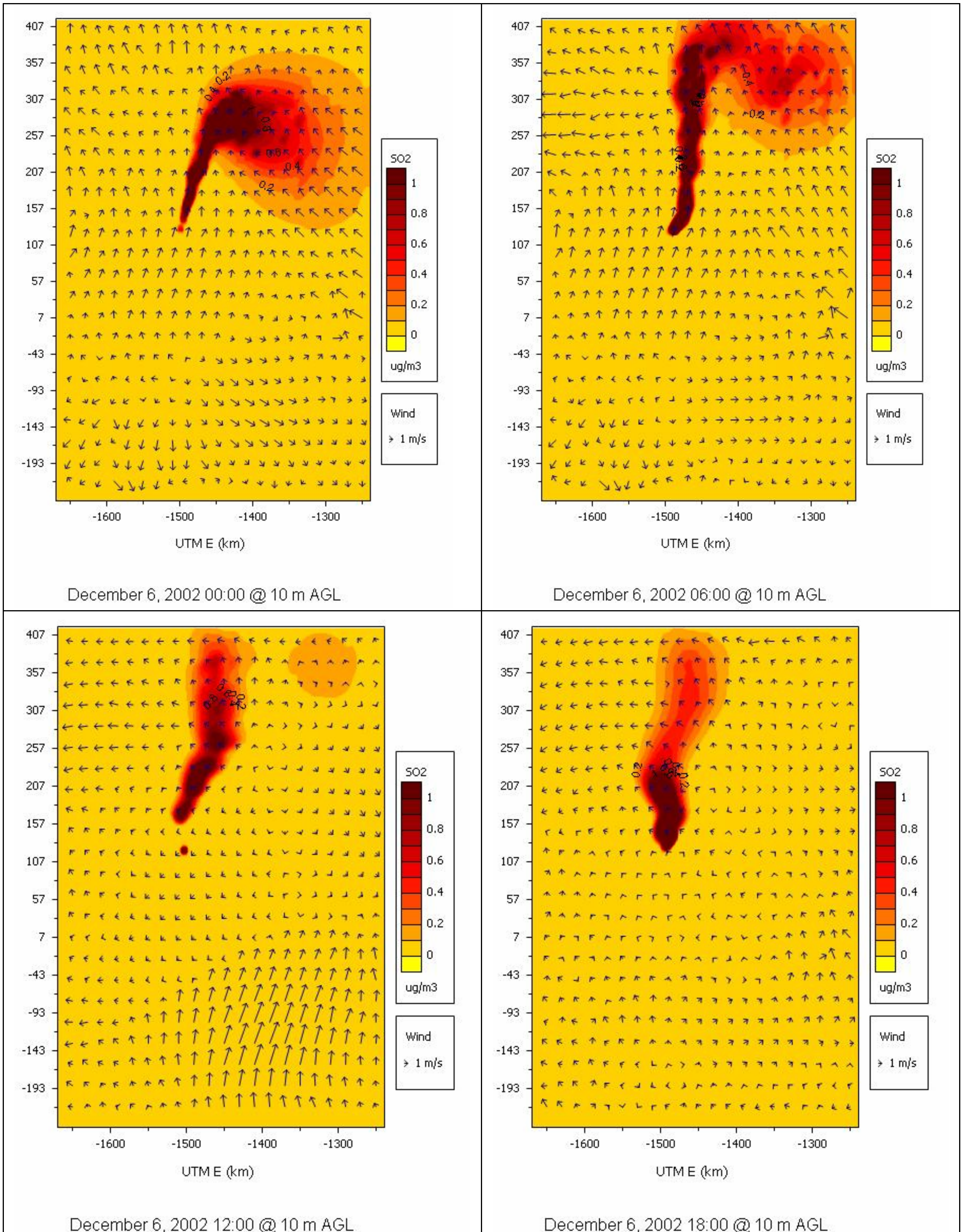

Figure 3-2a. CALPUFF-estimated hourly SO_2 concentrations (μg/m^3) at 00:00, 06:00, 12:00 and 18:00 on December 6, 2002 shown with 10 meters above ground level (AGL) wind fields (m/s).

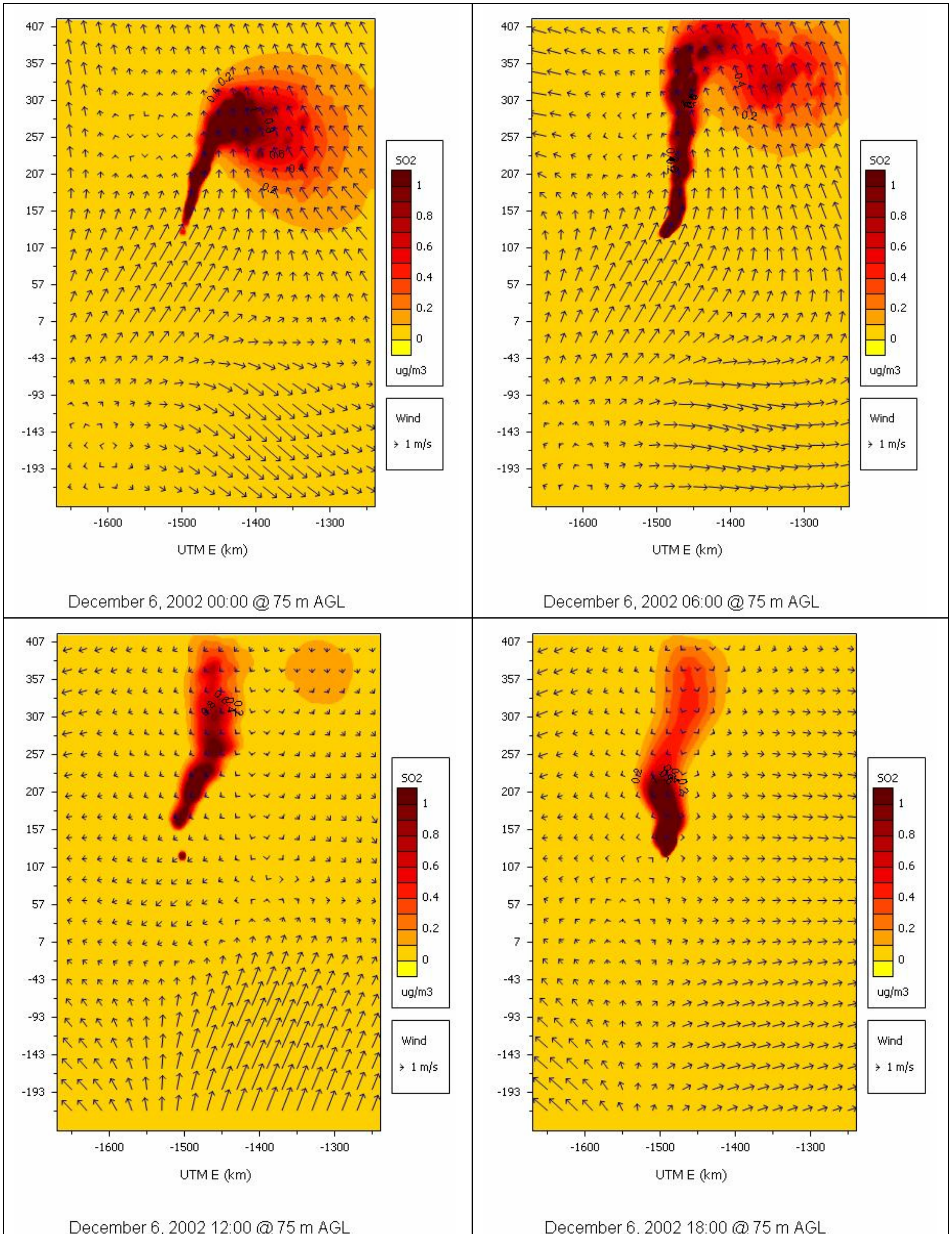

Figure 3-2b. CALPUFF-estimated hourly SO_2 concentrations ($\mu g/m^3$) at 00:00, 06:00, 12:00 and 18:00 on December 6, 2002 shown with 75 meters above ground level (AGL) wind fields (m/s).

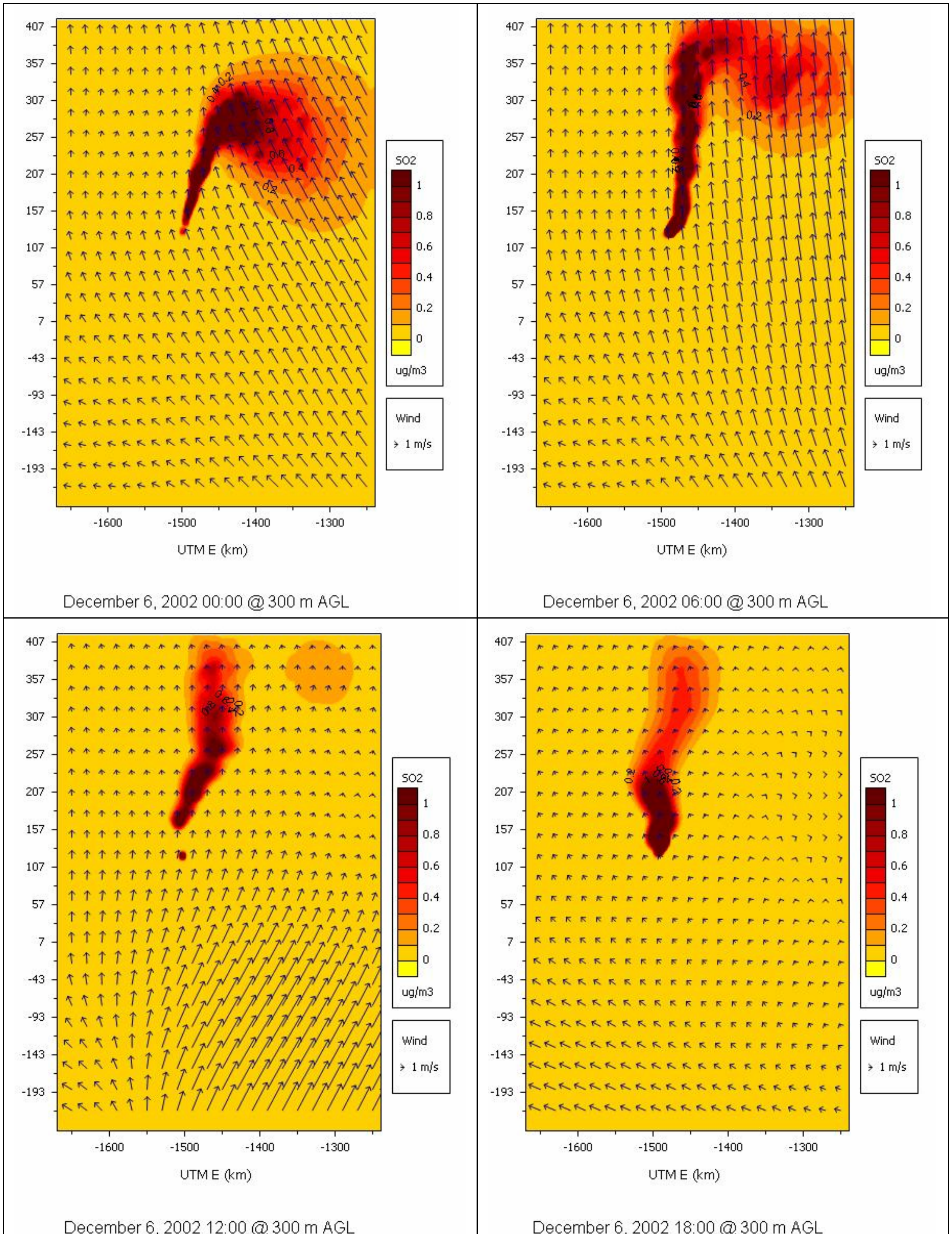

Figure 3-2c. CALPUFF-estimated hourly SO_2 concentrations (μg/m^3) at 00:00, 06:00, 12:00 and 18:00 on December 6, 2002 shown with 300 meters above ground level (AGL) wind fields (m/s).

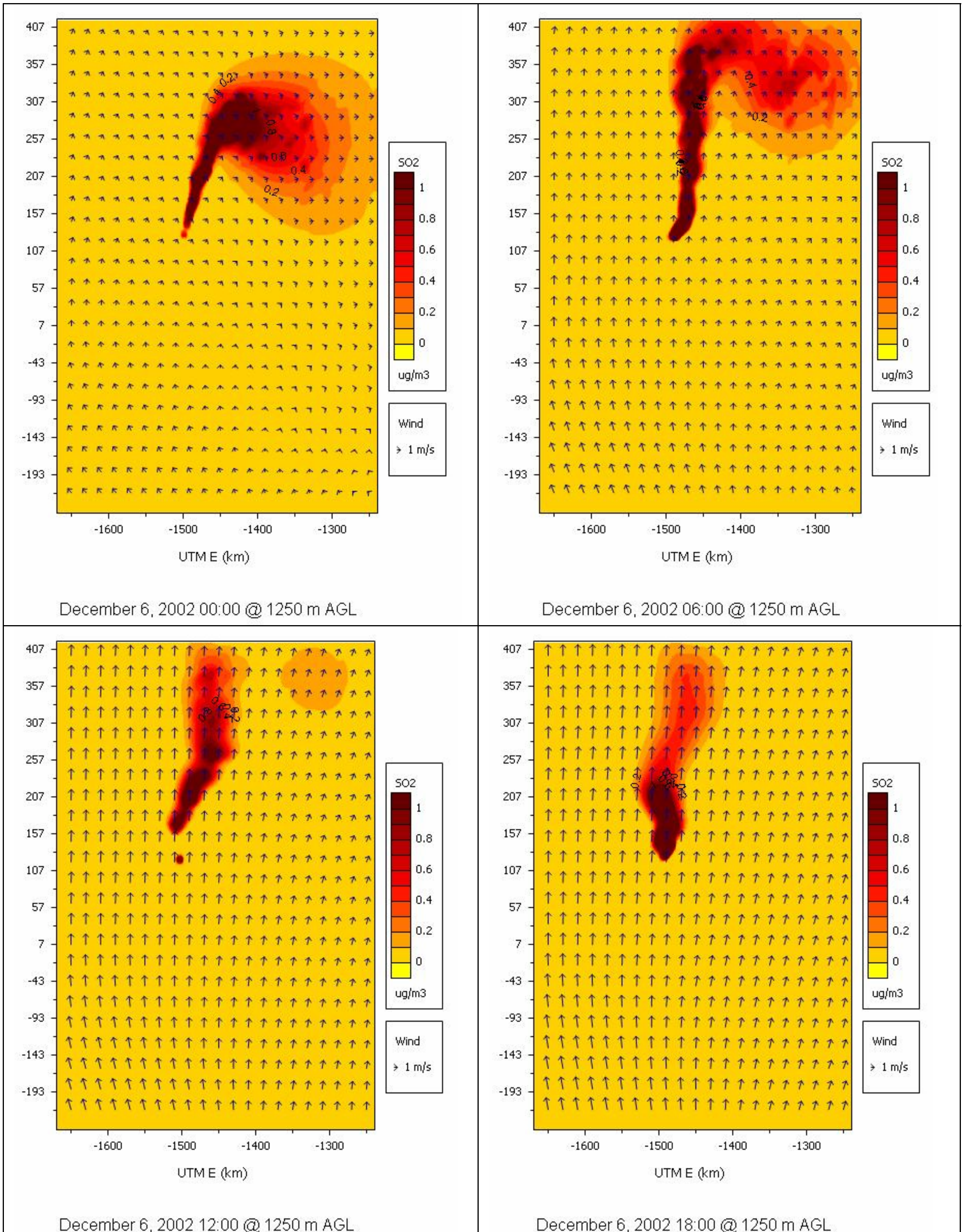

Figure 3-2d. CALPUFF-estimated hourly SO_2 concentrations (μg/m^3) at 00:00, 06:00, 12:00 and 18:00 on December 6, 2002 shown with 1250 meters above ground level (AGL) wind fields (m/s).

Conclusion

Given the infrequent occurrences of CALPUFF estimated 3-hour and 24-hour SO_2 concentrations exceeding the proposed single source SIL at the Jarbidge (< 1%) and Zion (< 0.1%) class I areas, the magnitude of the exceedances, the overestimation bias of the CALPUFF model at the long (~250-300 km) downwind distances to the Class I areas, (as demonstrated by IWAQM, 1998), and the clear documentation of CALPUFF failing to account for wind shear in its dispersion and transport and other unphysical properties leading to overstated impact in this application, when examining the frequency, duration and magnitude of the impacts the Project will likely not produce any concentrations above the proposed single source SIL for any PSD pollutant.

Visibility Impacts

The visibility impacts were first calculated from the refined CALPUFF modeling results following the procedures in the FLAG (2000) final report, which includes:

- Current IMPROVE extinction equation.
- Use of day-specific relative humidity adjustment factors [f(RH)] as provided in the CALPUFF modeling system.
- Use of Clean Natural Conditions for background that uses estimates of clean aerosol conditions and does not account for weather interference (e.g., fog, rain, snow, etc.) or other natural phenomena (smoke from fires, aerosols from sea salt, volcanoes, etc.).
- Use of 1.0 ppb background ammonia.

There were two updates made to the FLAG (2000) visibility impact procedures that were made in the basic analysis and are typically used in more recent Class I area impact assessments:

- Use of latest EPA (2003b) default Natural Conditions rather than the older FLAG (2000) values.
- Use of a maximum relative humidity (RHMAX) value of 95% compared to the 98% value recommended in FLAG (2000).

Another enhancement to the FLAG (2000) guidance used in this study was the speciation of the Project's PM_{10} emissions into its PM components: SO_4, NO_3, EC, OC, Other $PM_{2.5}$ and coarse particles ($PM_{2.5-10}$). The extinction properties of the individual PM components are greater than used for total PM_{10} so this speciation provides a more refined and conservative estimate of the visibility impacts than assuming the emissions are PM_{10}.

Table 3-6 summarizes the number of days the maximum daily CALPUFF estimated visibility impacts over Natural Conditions at the Jarbidge (JARB) and Zion (ZION) Class I areas exceed the 5% and 10% thresholds during the three years of modeling. Visibility impacts at Zion just barely exceed the 10% threshold for one day (10.6%). There are 16 days in the three years when the Project's visibility impact is estimated to exceed the 10% change in extinction of natural conditions threshold. Details on the daily visibility impacts at JARB and ZION for all days in the three modeling years that exceeded the 5% change in extinction threshold are provided in

Table 3-7. On a vast majority of modeling days (>96%) the proposed Project is estimated to have no visibility impacts at either of the two Class areas.

Table 3-6. CALPUFF estimated maximum daily extinction estimates at Class I areas for the WPEA Project (3-boiler design, 1 km CALMET meteorological fields, with puff splitting, 1 ppb ammonia and using the basic FLAG procedures for visibility calculations).

	Class I Area Visibility Impacts		
	# Days > 5%	# Days >10%	Max Change (%)
Jarbidge (JARB)			
1996	9	4	22.4
2001	15	8	29.8
2002	8	4	32.3
Zion (ZION)			
1996	2	1	10.6
2001	3	0	6.3
2002	4	0	7.7

A couple of observations can be seen from the days the CALPUFF estimated visibility exceeds 5% at Jarbidge and Zion using the FLAG method using the 1 km grid with puff splitting CALPUFF modeling results (Table 3-7):

- On many of the days that the estimated Project's visibility exceeds the 5% threshold have very high f(RH) factors. For example, at Zion on Julian day 276 in 2002 when a 5.67% visibility impact is estimated a 9.369 f(RH) factor is used. CALPOST uses outdated f(RH) factors from an old "IMPROVE report" that overstate the f(RH) factors. For example, the CALPOST f(RH) factor at 95% RH is 9.7793, which is over 30% higher than the EPA guidance f(RH) factor of 7.40 at 95% RH (EPA, 2003b). Furthermore, the accuracy of RH measurements is not as precise as some other meteorological variables with errors of ±5%.
- On most days particulate nitrate is a major contributor to the Project's light extinction and on some days it is the most significant contributor (e.g., day 304 in 1996). The CALPUFF nitrate chemistry is know to overstate secondary nitrate (Morris, Lau and Koo, 2005), thus days with high nitrate impacts are likely modeling artifacts.
- The visibility background assumes clear skies with no weather or other interference with visual ranges of 170 km or more. The presence of a minimal amount of water vapor, smoke, dust, salt or other natural occurring visibility obstructing would increase the natural background visibility and reduce the Project's impacts to below 5%.

These issues are examined in more detail below.

Table 3-7. Estimated daily visibility impacts at Jarbidge and Zion Class I areas due to the proposed Project for days that exceed the 5% change in extinction over natural conditions threshold (3-boiler design, 1 km CALMET meteorological fields, with puff splitting, 1 ppb ammonia and using the basic FLAG procedures for visibility calculations).

YEAR	DAY	REC	Bext	BKG	Bext(tot)	%	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
Jarbidge Wilderness Area Class I Area (JARB)													
1996	35	165	3.59	16.041	19.631	**22.38**	6.673	1.322	1.671	0.506	0.018	0.026	0.046
1996	48	156	1.029	15.227	16.256	**6.76**	3.147	0.524	0.357	0.127	0.005	0.005	0.012
1996	178	1	1.288	15.644	16.932	**8.23**	3.813	0.909	0.195	0.159	0.006	0.005	0.014
1996	284	94	0.956	14.893	15.849	**6.42**	1.047	0.334	0.081	0.466	0.017	0.016	0.042
1996	304	15	3.023	16.648	19.671	**18.16**	5.727	0.471	2.396	0.133	0.005	0.007	0.012
1996	314	94	0.78	14.881	15.661	**5.24**	1.528	0.206	0.353	0.188	0.007	0.01	0.017
1996	315	65	3.006	14.928	17.934	**20.14**	1.718	0.922	1.201	0.753	0.028	0.034	0.068
1996	316	156	1.465	14.873	16.338	**9.85**	1.498	0.39	0.704	0.317	0.012	0.014	0.029
1996	317	156	1.968	14.855	16.823	**13.25**	1.427	0.536	0.665	0.654	0.024	0.031	0.059
2001	8	165	3.292	15.349	18.641	**21.45**	4.102	1.287	1.567	0.373	0.014	0.018	0.034
2001	9	18	1.719	15.838	17.556	**10.85**	6.462	0.843	0.829	0.039	0.001	0.002	0.004
2001	21	156	0.871	15.03	15.901	**5.79**	2.562	0.303	0.352	0.183	0.007	0.008	0.017
2001	22	79	1.504	15.007	16.51	**10.02**	2.447	0.66	0.568	0.236	0.009	0.01	0.021
2001	23	4	2.395	15.038	17.433	**15.92**	2.601	1.187	0.758	0.384	0.014	0.017	0.035
2001	24	18	4.565	15.299	19.864	**29.84**	3.858	2.287	1.37	0.772	0.028	0.038	0.07
2001	26	1	2.495	15.537	18.032	**16.06**	5.011	0.927	1.311	0.218	0.008	0.011	0.02
2001	63	52	1.442	14.957	16.399	**9.64**	1.603	0.478	0.309	0.556	0.02	0.029	0.05
2001	309	156	1.557	14.872	16.428	**10.47**	1.493	0.662	0.402	0.42	0.015	0.02	0.038
2001	310	165	1.155	14.868	16.023	**7.77**	1.477	0.401	0.329	0.361	0.013	0.019	0.033
2001	314	94	0.765	14.796	15.561	**5.17**	1.191	0.212	0.248	0.26	0.01	0.012	0.023
2001	315	79	0.754	14.854	15.608	**5.08**	1.422	0.291	0.138	0.277	0.01	0.014	0.025
2001	316	165	0.931	14.988	15.919	**6.21**	1.96	0.302	0.102	0.448	0.016	0.022	0.04
2001	363	156	3.194	15.997	19.191	**19.96**	7.03	1.924	1.135	0.115	0.004	0.005	0.01
2001	364	165	1.589	16.202	17.791	**9.81**	7.989	1.05	0.491	0.041	0.001	0.002	0.004
2002	2	4	5.027	15.56	20.587	**32.31**	5.12	2.922	1.377	0.621	0.023	0.029	0.056
2002	47	4	1.13	14.814	15.943	**7.63**	1.359	0.468	0.105	0.474	0.017	0.022	0.043
2002	259	165	0.923	15.573	16.496	**5.92**	2.502	0.383	0.194	0.294	0.011	0.014	0.027
2002	325	156	1.654	15.561	17.215	**10.63**	4.259	0.688	0.278	0.586	0.021	0.028	0.053
2002	334	1	1.499	14.875	16.374	**10.08**	1.506	0.55	0.404	0.467	0.017	0.019	0.042
2002	340	18	1.512	15.03	16.542	**10.06**	2.49	0.783	0.308	0.361	0.013	0.015	0.033
2002	341	165	0.934	14.77	15.704	**6.33**	1.267	0.467	0.108	0.309	0.011	0.011	0.028
2002	343	156	0.968	14.882	15.85	**6.5**	1.793	0.419	0.222	0.279	0.01	0.012	0.025
Zion National Park Class I Area (ZION)													
1996	6	188	1.597	15.08	16.677	**10.59**	2.614	0.499	0.881	0.186	0.007	0.008	0.017
1996	76	221	0.881	14.994	15.876	**5.88**	1.648	0.249	0.393	0.204	0.007	0.01	0.018
2001	29	225	0.975	15.81	16.786	**6.17**	5.903	0.42	0.492	0.054	0.002	0.002	0.005
2001	327	221	1.045	16.61	17.656	**6.29**	7.035	0.453	0.459	0.114	0.004	0.005	0.01
2001	361	221	0.873	14.947	15.82	**5.84**	1.795	0.305	0.387	0.155	0.006	0.007	0.014
2002	98	223	1.272	16.534	17.806	**7.69**	5.423	0.633	0.571	0.059	0.002	0.002	0.005
2002	276	214	1.027	18.013	19.04	**5.7**	9.369	0.596	0.39	0.035	0.001	0.001	0.003
2002	304	210	1.164	15.818	16.982	**7.36**	3.515	0.561	0.477	0.107	0.004	0.005	0.01
2002	307	225	1.118	15.363	16.482	**7.28**	2.878	0.51	0.444	0.14	0.005	0.006	0.013

Effects of Uncertainties in Relative Humidity and Particle Growth

The effects of the uncertainties in relative humidity (RH) and particle growth on the CALPUFF-estimated visibility impacts at the two Class I areas were examined two ways:

- Use of monthly average f(RH) values as recommended in EPA's guidance for calculating visibility from aerosol concentrations (EPA, 2003a); and
- Use of the latest f(RH) values from EPA guidance (EPA, 2003b), instead of the outdated values in the CALPUFF modeling system that were taken from IMPROVE (e.g., Malm et. al., 2000).

Table 3-8 lists the number of days the CALPUFF-estimated visibility at the two Class I areas exceeds the 5% and 10% thresholds using daily CALPUFF f(RH) (i.e., same as Table 3-6), using monthly average f(RH) (MVISBK=6) and using daily f(RH) values from EPA guidance (EPA, 2003c). The daily f(RH) values are generally more conservative estimating more days that exceed the 5% and 10% visibility thresholds than using the monthly average values. The number of days exceeding the 5% threshold at Zion is reduced from 8-9 using daily f(RH) values to 2 using the monthly f(RH) values. Use of the daily f(RH) values from EPA guidance (EPA, 2003c) also tends to reduces the visibility impacts at the two Class I areas over use of the outdated f(RH) values in the CALPUFF modeling system.

In summary, it appears that uncertainties in the treatment of aerosol growth and RH values affect the calculated visibility impacts at the two Class I areas. Use of the more recent f(RH) values from EPA guidance (EPA, 2003b) reduces the visibility impacts compared to use of the FLAG (2000) f(RH) values that are outdated.

Table 3-8. Sensitivity of the Project's CALPUFF estimated visibility impacts at Class I areas to relative humidity (RH) including original daily CALPUFF f(RH) and EPA guidance (EPA, 2003b) monthly and daily f(RH) values (3-boiler design, 1 km CALMET meteorological fields, with puff splitting, 1 ppb ammonia and using the basic FLAG procedures for visibility calculations).

	Daily CALPUFF f(RH)			EPA Guidance Monthly f(RH)			EPA Guidance Daily f(RH)		
	#Days > 5%	# Days >10%	Max (%)	#Days > 5%	#Days >10%	Max (%)	#Days > 5%	#Days >10%	Max (%)
JARB									
1996	9	4	22.4	7	4	23.5	9	5	21.2
2001	15	8	29.8	15	7	22.7	15	8	27.4
2002	8	4	32.3	8	5	21.9	8	4	28.5
ZION									
1996	2	1	10.6	1	0	7.2	2	0	9.7
2001	3	0	6.3	1	0	7.0	3	0	6.3
2002	4	0	7.7	0	0	4.0	3	0	7.2

Effects of CALPUFF Chemistry Uncertainties and Inaccuracies

Morris and co-workers (2003; 2005; 2006) have discussed the uncertainties and bias of the CALPUFF chemistry algorithms and found them to be inaccurate and unreliable with a likely overestimation bias under most conditions. The CALPUFF chemistry algorithms were developed in 1983, over two decades ago (Scire et al., 1983; Atkinson Lloyd and Winges, 1982). More recently, the CALPUFF chemistry algorithms were implemented in a full-science photochemical grid model, EPA's Community Multi-scale Air Quality (CMAQ) modeling system, and the results for January and July 2002 test periods were compared against real-world ambient measurements collected at several networks (e.g., IMPROVE, CASTNet, STN and SEARCH) (Morris et al., 2005). The CALPUFF chemistry sulfate formation rates exhibited little seasonal variation, which is partly due to not including temperature as one of the parameters. The CALPUFF chemistry sulfate estimates generally remained within an order magnitude of the observations, with a slight winter overestimation and summer underestimation bias. However, CALPUFF chemistry algorithms greatly overstated the observed nitrate concentrations producing inaccurate and overstated particle nitrate estimates, especially in the winter. As most of the high visibility estimates due to the Project occur in the winter, the winter bias is of issue in this study. Figure 3-3 displays comparisons of the standard (full-chemistry) version of the CMAQ model (CMAQ Version 4.4) and the CMAQ versions with the CALPUFF MESOPUFF-II chemistry (CMAQ-LISBON MESOPUFF) against measured nitrate (NO3) observations at the IMPROVE and CASTNet monitors in the western US (WRAP region) as well as the continental US. Comparisons of the measured nitrate observations with the nitrate estimates using the CALPUFF chemistry in January 2002 reveal an overestimation tendency, with fractional bias values of 97% (IMPROVE) and 103% (CASTNet) in the western US and bias values of 101% and 92% when looking at the continental US. Thus, the CALPUFF chemistry appears to have approximately a factor of 2 overestimation bias in winter time nitrate concentrations, and this over-prediction bias is independent of the other factors that results in CALPUFF overestimations (e.g., too little plume dispersion) discussed previously.

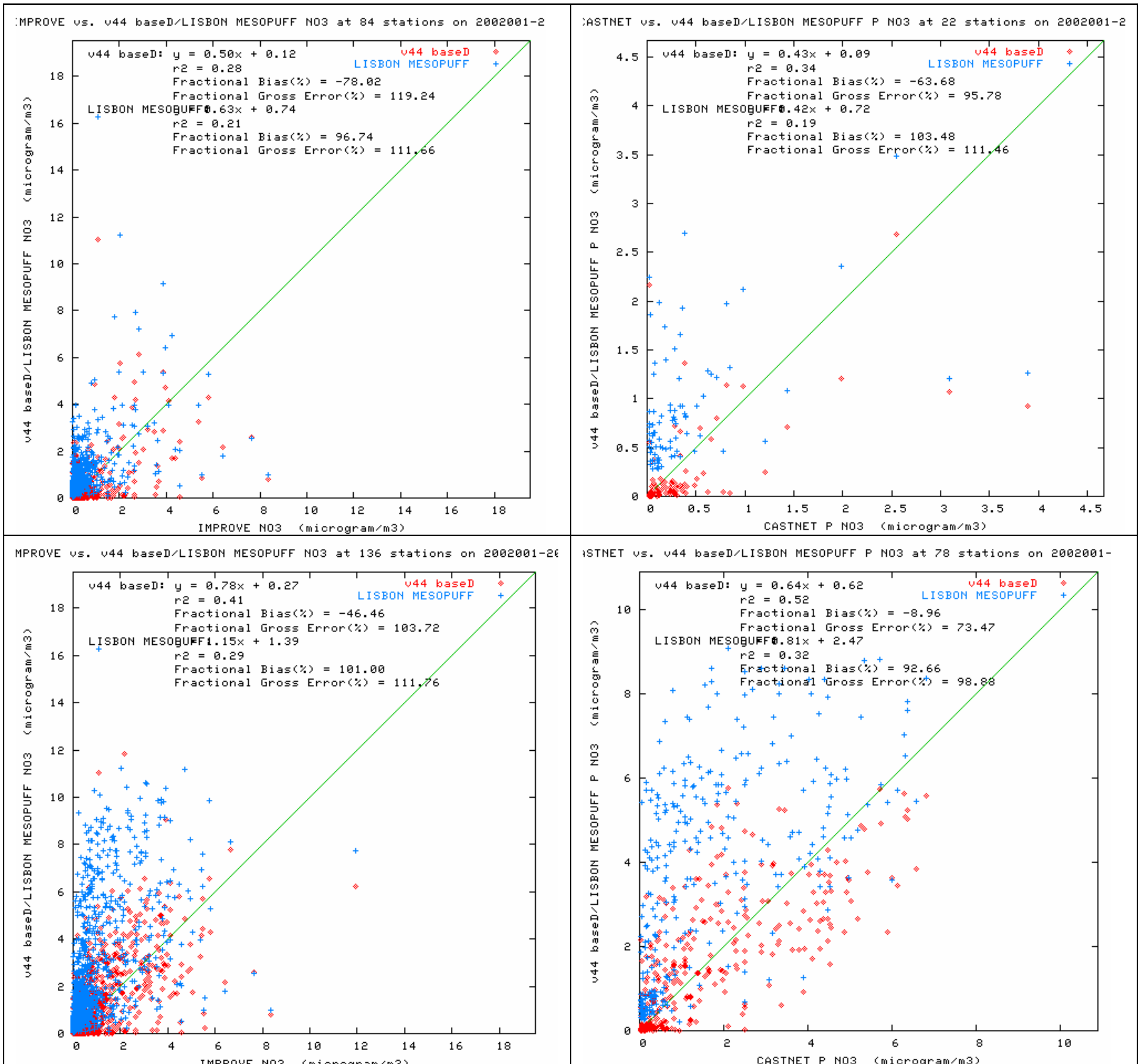

Figure 3-3. Nitrate (NO3) model performance for January 2002 of the standard CMAQ V4.4 (red) and the CMAQ-LISBON with the CALPUFF MESOPUFF-II chemistry (blue) using IMPROVE (left) and CASTNet (right) monitoring networks for the western US (top) and entire US (bottom) regions.

Morris, Lau, Koo and Yarwood(2006) estimated the effects that the CALPUFF chemistry would have on visibility impacts from a single source using the CMAQ modeling platform and found it greatly overstated the number of days per year change in visibility impacts exceeded specific thresholds. The reduced SO2 and NOx emissions by 20 and 10 tons per day in a grid cell and ran the standard full-science version of CMAQ and the CMAQ with CALPUFF chemistry (CMAQ-LISBON) and looked at the visibility impacts at various downwind distances. Figure 3-4 displays the locations source where the visibility impacts were compared using the CMAQ full-science and CALPUFF simplified chemistry. The closest site to the proposed Project is the southwest Wyoming (SWWY) source. The cumulative distribution of the maximum daily visibility impacts downwind of the SWWY source in January and July 2002 using the CMAQ and CALPUFF chemistry are shown in Figure 3-5. The model estimated visibility in July using the CALPUFF chemistry agrees reasonable well with that produced by the CMAQ chemistry. Closer inspection reveals that the CALPUFF chemistry under-prediction of sulfate in July is compensated by over-prediction of nitrate. However, in January the CALPUFF chemistry greatly overestimate the visibility impacts. The percentage of the number of days exceeding the 10% and 20% thresholds using the CMAQ chemistry (~5% and ~10%, respectively) is overstated by a factor of approximately 5 using the CALPUFF chemistry (~25% and ~60%).

Looking at this finding in the context of the current visibility analysis for the Project, we estimate that 32 and 9 days, respectively, exceed the 5% change in extinction threshold at Jarbidge and Zion Class I areas, respectively, using the CALPUFF chemistry. If full-science chemistry was used the number of days exceeding the 5% threshold would be closer to 1-2 and 0 for Jarbidge and Zion, respectively.

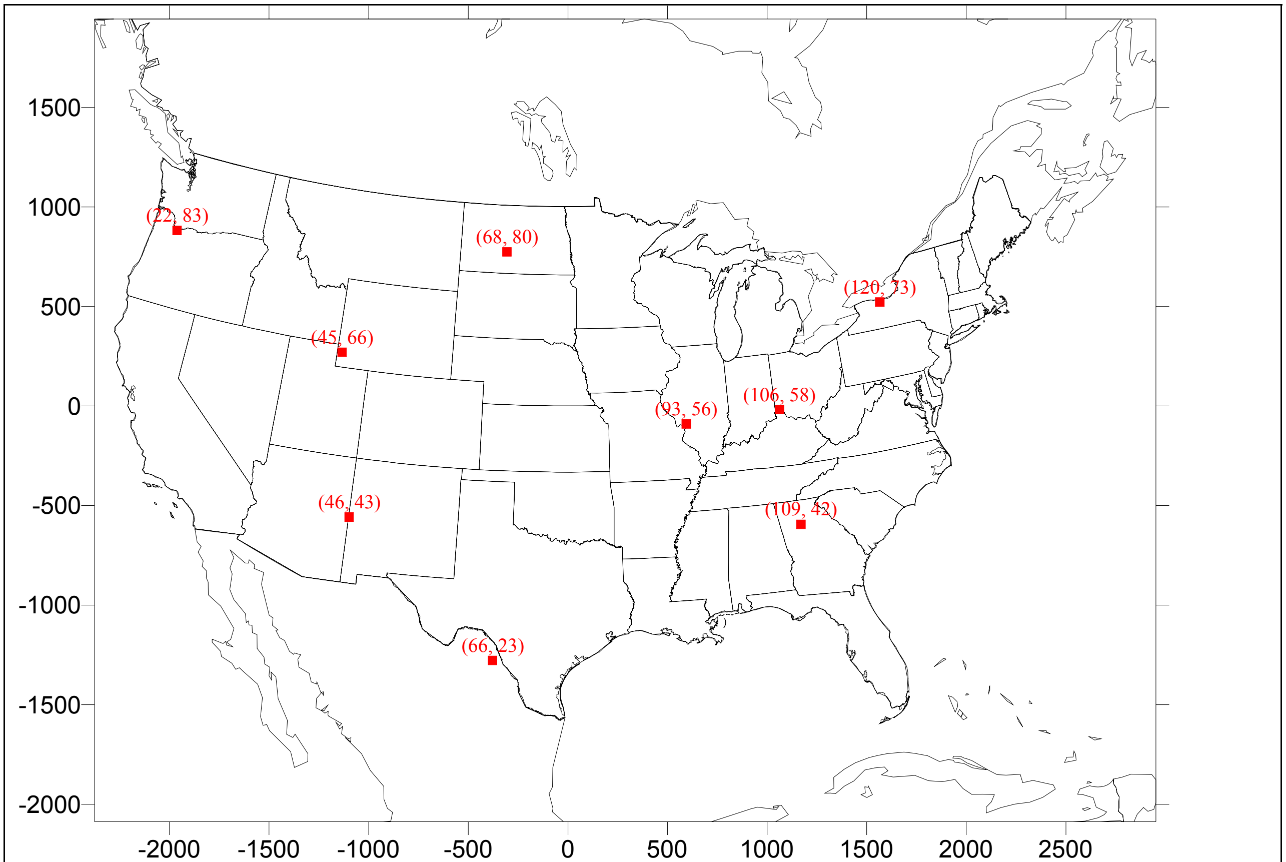

Figure 3-4. Locations of sources whose visibility imp[acts were examined using the CMAQ full-science and CALPUFF simplified chemistry (Source: Morris, Lau, Koo and Yarwood, 2006).

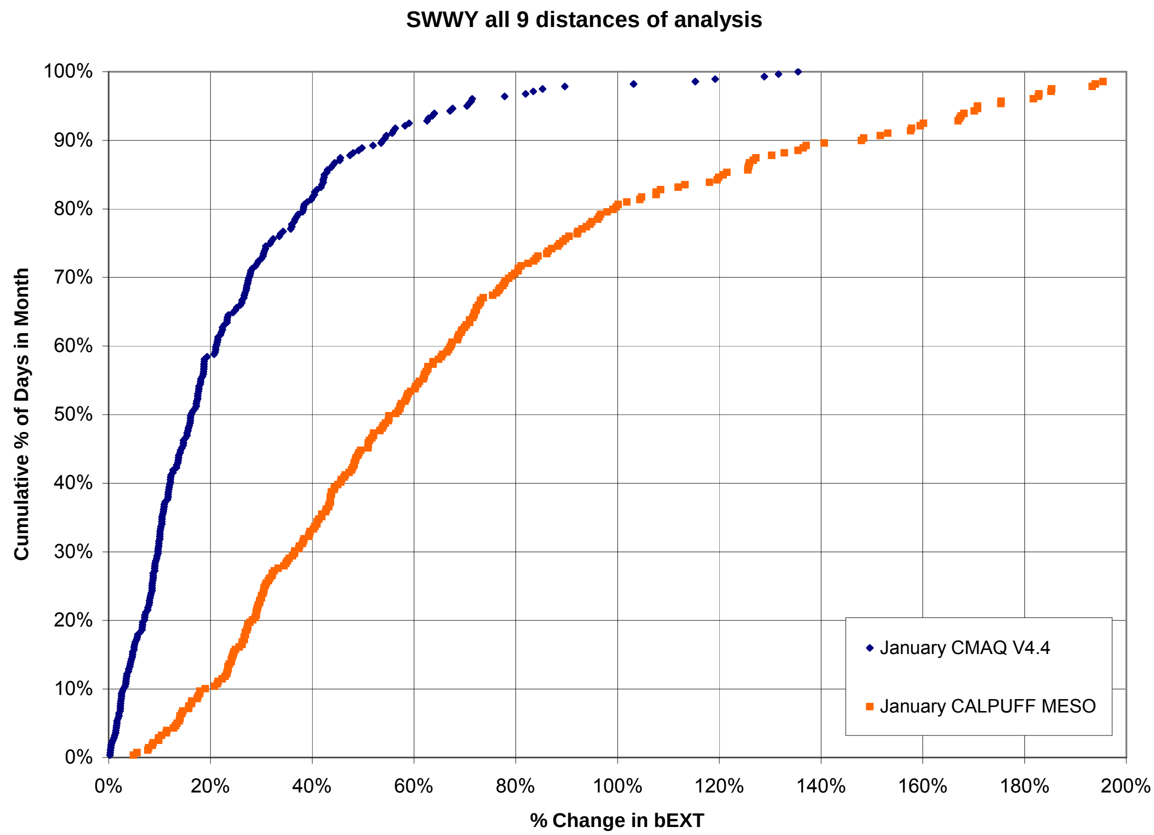

Figure 3-5a. Cumulative distribution of daily maximum visibility impacts in January 2002 at 9 downwind distances from the Southwest Wyoming source using the standard CMAQ model and CMAQ-LISBON with CALPUFF chemistry (Source: Morris, Lau, Koo and Yarwood, 2006).

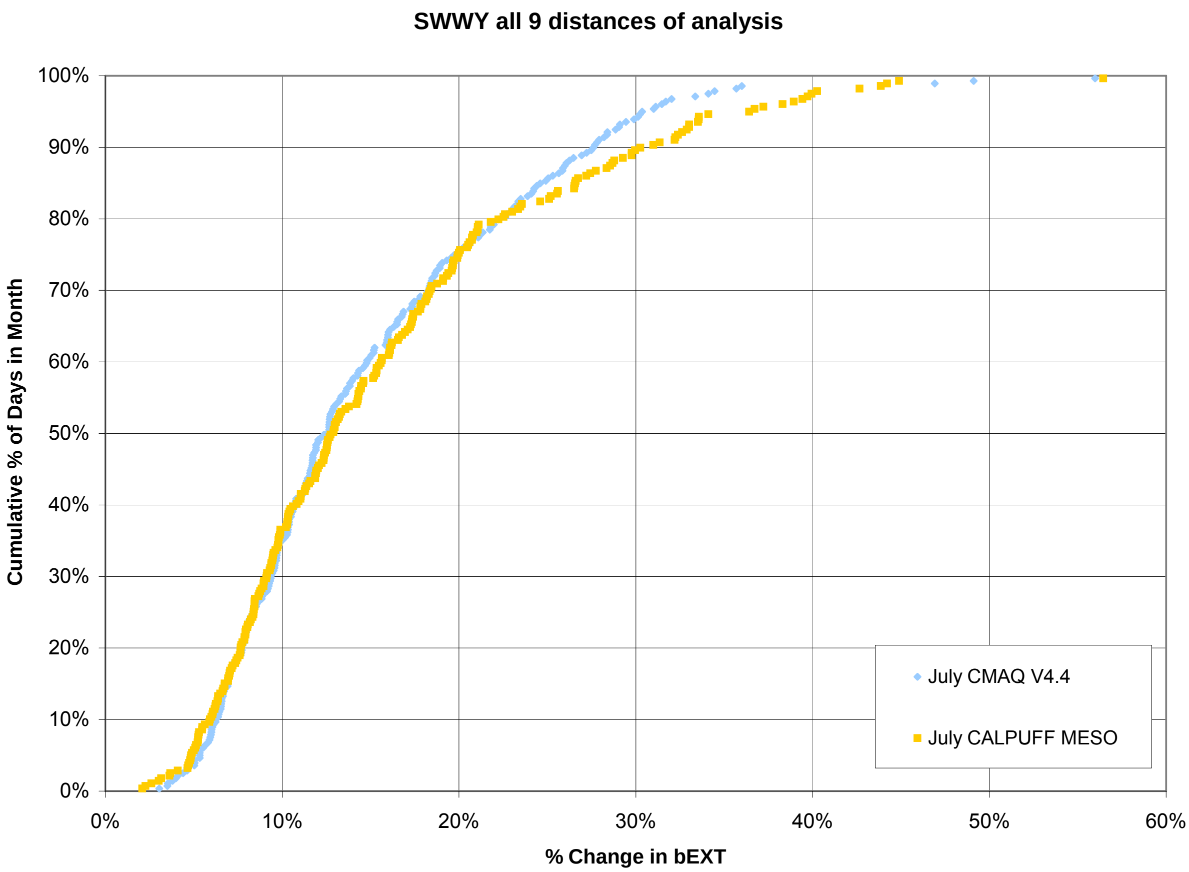

Figure 3-5b. Cumulative distribution of daily maximum visibility impacts in July 2002 at 9 downwind distances from the Southwest Wyoming source using the standard CMAQ model and CMAQ-LISBON with CALPUFF chemistry (Source: Morris, Lau, Koo and Yarwood, 2006).

Effects of Natural Obscuration

The issue of natural phenomena effects on Natural Background in visibility assessments has been discussed and there have been various procedures proposed for incorporating weather interference (e.g., presence of atmospheric liquids water content) and other natural obscuration phenomena (e.g., sea salt) in the Natural Background. In fact, one of the options in the CALPUFF modeling system for assessing visibility impacts uses observed background visibility (MVISBK=7) rather than estimates of Natural Background based on clean aerosol concentrations with no weather interference.

Appendix A lists the observed surface weather observations for the closest site to each Class I area for each day during many days during the 3 years of modeling in which the CALPUFF estimated visibility exceeds 5% using the original basic FLAG procedures (i.e. results in Tables 3-6 and 3-7). For Jarbidge Class I area the Elko, Nevada site was used that lies approximately 100 km south of Jarbidge Table 3-9 lists an example of hourly surface weather observations from Appendix A for February 4, 1996. Recall this is the day with the highest visibility impacts at Jarbidge. The key parameters related to weather interference are the occurrence of rain and snow for which the following codes apply for Rain (similar for the other precipitation types only substitute for Rain):

0 = None
1 = Light rain
2 = Moderate rain
3 = Heavy rain
4 = Light rain showers
5 = Moderate rain showers
6 = Heavy rain showers
7 = Light freezing rain
8 = Moderate freezing rain
9 = Heavy freezing rain

For February 4, 1996, the local weather observations indicate that light rain or snow is falling in 13 of 24 hours in the day. When accounted for in the natural background, the presence of just one hour of rain or snow would increase the 24-hour average natural background extinction by over a factor of ten so that the calculated visibility impacts on this day would be less than 5%. Thus, when accounting for rain in the visibility background the change in extinction over natural background would be reduced to below the 5% threshold.

Table 3-9. Summary of hourly surface meteorological observations at NWS site nearest to the Jarbidge Class I area on February 4, 1996.

Site	Date	Hour	Ceiling H	Rain	Drizzle	Snow	Snow Shower	Ice Pellets	WD	WS	Stn P	T	RH	Sky Cover
24128	2/4/1996	0	55	0	0	0	0	0	6	13	2576	26	75	-
24128	2/4/1996	1	100	0	0	0	0	0	5	16	2575	25	81	-
24128	2/4/1996	2	55	0	0	0	0	0	6	12	2575	26	75	-
24128	2/4/1996	3	49	0	0	0	0	0	6	12	2575	27	75	-
24128	2/4/1996	4	47	0	0	0	0	0	6	13	2575	26	78	-
24128	2/4/1996	5	65	1	0	0	0	0	5	9	2574	27	78	-
24128	2/4/1996	6	48	1	0	0	0	0	5	7	2574	28	82	-
24128	2/4/1996	7	48	0	0	1	0	0	6	10	2574	28	85	-
24128	2/4/1996	8	47	1	0	0	0	0	6	9	2575	29	92	-
24128	2/4/1996	9	41	1	0	0	0	0	6	12	2575	30	89	-
24128	2/4/1996	10	19	1	0	0	0	0	5	10	2576	30	92	-
24128	2/4/1996	11	36	1	0	0	0	0	5	10	2578	31	96	-
24128	2/4/1996	12	7	1	0	0	0	0	6	8	2575	32	92	-
24128	2/4/1996	13	7	1	0	0	0	0	6	8	2575	32	96	-
24128	2/4/1996	14	28	1	0	0	0	0	4	4	2575	33	96	-
24128	2/4/1996	15	7	1	0	0	0	0	8	7	2575	33	96	-
24128	2/4/1996	16	7	1	0	0	0	0	5	6	2576	33	96	-
24128	2/4/1996	17	32	1	0	0	0	0	6	7	2575	33	96	-
24128	2/4/1996	18	65	0	0	0	0	0	7	7	2576	33	96	7
24128	2/4/1996	19	55	0	0	0	0	0	5	7	2577	33	100	-
24128	2/4/1996	20	---	0	0	0	0	0	5	5	2576	33	96	0
24128	2/4/1996	21	60	0	0	0	0	0	5	13	2575	33	100	7
24128	2/4/1996	22	---	0	0	0	0	0	5	14	2576	33	100	3
24128	2/4/1996	23	---	0	0	0	0	0	7	10	2578	34	96	3

There are several reasons why the CALPUFF/FLAG approach greatly overstates visibility at Class I areas on rainy or snowy days. First, and probably foremost, including the atmospheric liquid water vapor atmospheric obscuration properties in the natural background visibility increases it by over a factor of ten thereby reducing all impacts above 5% to below the 5% threshold. Second, associated with rain is high relative humidity (RH) that increase the visibility impacts two ways: (1) through higher f(RH) factors when calculating extinction; and (2) with higher sulfate formation rates from the CALPUFF (erroneous) aqueous-phase sulfate formation equations. The CALPUFF aqueous phase sulfate formation parameterization is widely recognized as being incorrect and highly inaccurate (Garrison et al., 1999; Morris, et al., 2003; 2005; 2006).

An examination of the weather occurrences during the days greater than 5% at Jarbidge and Zion in Appendix A reveals that rain and/or snow was falling at the closest weather station to the Jarbidge and Zion Class I areas for many of the estimated adverse visibility days. These events are summarized in Table 3-10. For these days any visibility impacts from the WPEA would be naturally obscured so they would be reduced below the 5% threshold:

Table 3-10. Weather interference events during estimated adverse visibility days (see Appendix C for details).

Date	Julian Date	Comment
Jarbidge Class I Area		
02/04/96	96035	13 Hours of Rain/Snow
02/17/96	96048	1 Hour of Rain
06/26/96	96178	8 Hours of Rain
10/30/96	96304	5 Hours of Rain
01/11/01	01011	9 Hours of Rain
01/24/01	01024	4 Hours of Rain/Snow
11/11/01	01315	2 Hours of Rain
11/12/01	01316	1 Hour of Rain
12/29/01	01363	3 Hours of Snow
12/30/01	01364	1 Hour of Rain
01/02/02	02001	2 Hours of Rain, some Moderate
09/16/02	02260	2 Hours of Rain, some Moderate
Zion Class I Area		
1/29/01	01029	9 Hours of Snow
11/23/01	01327	7 Hours of Rain
04/08/02	02098	5 Hours of Rain, some Moderate
10/03/02	02276	6 Hours of Rain
10/31/02	02304	4 Hours of Snow

Deposition

The CALPUFF CALPOST postprocessor can provide annual dry and wet deposition for each modeled species and each receptor. CALPOST was run to provide annual total dry and wet deposition in units of $\mu g/m^2/s$ for SO2, SO4, NOx, HNO3 and NO3 species at each receptor in the Jarbidge and Zion Class I areas. The deposition values were averaged across all receptors in each Class I area to get an area-wide average deposition estimate for each Class I area and then the units of the annual deposition were converted from $\mu g/m^2/s$ to kg/ha/yr for comparison with thresholds (see Table 3-2). The deposition for each of the sulfur species (SO2 and SO4) and nitrogen species (NOx, HNO3 and NO3) were then converted to deposition of sulfur or nitrogen, respectively, and then summed to get total sulfur or nitrogen deposition. These results are presented in Tables 3-11 and 3-12.

The CALPUFF-estimated annual total Sulfur (S) and Nitrogen (N) deposition due to the Project's emissions at either the Jarbidge or Zion Class I areas are from 0.04% to 0.6% of the Forest Service "greenline" threshold of adverse impact (3.0 kg/ha/yr) for the three years modeled. The estimated annual total nitrogen deposition due to the Project's emissions at the two Class I areas range from 0.0009 to 0.0037 kg-N/ha/yr which is below the NPS western US Deposition Analysis Threshold (DAT) of 0.005 kg-N/ha/yr. At the Jarbidge Class I area, the estimated annual total sulfur deposition is below the NPS western US DAT (0.005 kg-S/ha/yr) for 1996 (0.0024 kg-S/ha/yr). However, for 2001 and 2002 the estimated total sulfur deposition (0.0171 and 0.0177 kg-S/ha/yr) at Jarbidge is above the NPS western US DAT (0.005 kg-S/ha/yr). At the Zion Class I area the estimated sulfur deposition for the three years (0.0068, 0.0086 and 0.0059 kg-S/ha/yr) is between the NPS western US DAT (0.005 kg/ha/yr) and eastern US DAT (0.010 kg/ha/yr).

Table 3-11a. Nitrogen deposition (kg-N/ha/yr) averaged across the Jarbidge Class I area for the three years of CALPUFF modeling.

	Dry Deposition	Wet Deposition	Total Deposition
FS Threshold			***3.000***
NPS DAT			***0.005***
1996			
HNO3	0.000305	0.000039	
NO3	0.000016	0.000088	
NOX	0.000425	0.000000	
Total N	0.000746	0.000127	0.000873
2001			
HNO3	0.000530	0.001347	
NO3	0.000032	0.001108	
NOX	0.000681	0.000000	
Total N	0.001243	0.002455	0.003698
2002			
HNO3	0.000328	0.000897	
NO3	0.000017	0.001182	
NOX	0.000556	0.000000	
Total N	0.000901	0.002079	0.002980

Table 3-11b. Sulfur deposition (kg-S/ha/yr) averaged across the Jarbidge Class I area for the three years of CALPUFF modeling.

	Dry Deposition	Wet Deposition	Total Deposition
FS Threshold			***3.000***
NPS DAT			***0.005***
1996			
SO2	0.002034	0.000197	
SO4	0.000021	0.000188	
Total S	0.002055	0.000385	0.002440
2001			
SO2	0.005024	0.010286	
SO4	0.000052	0.001748	
Total S	0.005076	0.012034	0.017110
2002			
SO2	0.003081	0.012206	
SO4	0.000031	0.002418	
Total S	0.003111	0.014623	0.017735

Table 3-12a. Nitrogen deposition (kg-N/ha/yr) averaged across the Zion Class I area for the three years of CALPUFF modeling.

	Dry Deposition	Wet Deposition	Total Deposition
FS Threshold			***3.000***
NPS DAT			***0.005***
1996			
HNO3	0.000318	0.000115	
NO3	0.000016	0.000756	
NOX	0.000693	0.000000	
Total N	0.001028	0.000871	0.001899
2001			
HNO3	0.000247	0.000160	
NO3	0.000034	0.000529	
NOX	0.000421	0.000000	
Total N	0.000702	0.000689	0.001391
2002			
HNO3	0.000196	0.000176	
NO3	0.000035	0.000302	
NOX	0.000342	0.000000	
Total N	0.000573	0.000478	0.001051

Table 3-12b. Sulfur deposition (kg-S/ha/yr) averaged across the Zion Class I area for the three years of CALPUFF modeling.

	Dry Deposition	Wet Deposition	Total Deposition
FS Threshold			***3.000***
NPS DAT			***0.005***
1996			
SO2	0.003183	0.003088	
SO4	0.000023	0.000539	
Total S	0.003206	0.003627	0.006833
2001			
SO2	0.002930	0.004648	
SO4	0.000053	0.000951	
Total S	0.002983	0.005599	0.008582
2002			
SO2	0.002336	0.002640	
SO4	0.000048	0.000833	
Total S	0.002384	0.003473	0.005857

4.0 CUMULATIVE SO2 INCREMENT CONSUMPTIONS ANALYSIS

In the initial CALMET/CALPUFF modeling analysis of the WPEA Project (Morris, Jia and Lau, 2006), the Federal Land Managers (FLMs) commented that the WPEA needs to perform a cumulative PSD sources increment consumption analysis for short-term SO2 concentrations. This was because the CALPUFF modeling indicated that the Class I area single-source Significant Impact Level (SIL) threshold for 3-hour and 24-hour SO2 concentrations were exceeded for all three modeling years at the Jarbidge (JARB) and for just one year (2001) and 3-hour SO2 at the Zion (ZION) Class I areas. This section presents the results of the cumulative SO2 increment consumption analysis. As with the rest of this report, a 1.0 ppb background ammonia concentration was assumed in the modeling.

CUMULATIVE SO2 PSD INCREMENT CONSUMPTION MODELING

A cumulative SO_2 PSD increment consuming emissions inventory was compiled by WPEA by contacting the State of Nevada and neighboring States. The inventory was provided to ENVIRON, who eliminated any sources outside of the WPEA CALMET/CALPUFF modeling domain. The resultant SO_2 PSD increment consuming inventory (as shown in Appendix B) was modeled in conjunction with the WPEA SO_2 emission sources in the CALPUFF modeling analysis. The cumulative SO_2 increment analysis evaluated the 3-hour SO_2 concentrations at Zion and the 3-hour and 24-hour SO_2 concentrations at JARB for 1996, 2001, and 2002.

The cumulative CALPUFF modeling was performed using the same assumptions as discussed in Section 3 for the single-source WPEA modeling, with the exception that puff splitting was not used. The use of puff splitting with this many sources (see Appendix B) would result in exorbitant computer time and, as shown in Section 3 (Table 3-5), puff splitting has very little effect on the CALPUFF estimated maximum concentrations (usually less than 3%, always less than 10%)

The cumulative SO_2 concentration estimates at the JARB and ZION Class I areas and their comparisons against the Class I PSD increments are provided in Table 4-1. The cumulative SO_2 PSD increment impacts in the region are estimated to be much lower than the Class I area PSD increment thresholds. The maximum percentage of the SO_2 increment consumed by the cumulative sources (i.e., WPEA plus surrounding sources) is 19% for 3-hour SO2 at JARB, 8% for 24-hour SO2 at JARB, and 16% for 3-hour SO_2 at ZION.

Table 4-1. CALPUFF estimated short-term SO2 PSD pollutant concentrations impacts at Class I areas for the WPEA Project plus cumulative SO2 sources (3-boiler design, 1 km CALMET meteorological fields, 1.0 ppb background ammonia and without puff splitting).

Species and Averaging Time	Class I Area Thresholds PSD Increment ($\mu g/m^3$)	Cumulative SO2 CALPUFF at Class I Areas Jarbidge	Zion
1996			
SO_2 24-Hour (1)	5.00	0.95	N/A (2)
SO_2 3-Hour (1)	25.00	2.02	3.98 (2)
2001			
SO_2 24-Hour (1)	5.00	0.55	N/A (2)
SO_2 3-Hour (1)	25.00	1.75	2.90
2002			
SO_2 24-Hour (1)	5.00	0.58	N/A (2)
SO_2 3-Hour (1)	25.00	1.85	3.17 (2)

Notes:
(1) Highest second high at any receptor in the Class I area.
(2) 24-hour impacts not included for Zion because predicted WPEA impacts at Zion did not exceed the 24-hour PSD Class I significance levels. Predicted 3-hour impacts due to the WPEA facility did not exceed the 3-hour PSD Class I significance levels for 1996 and 2002.

Based on the results shown in Table 4-1, it can be concluded that WPEA Project, along with the cumulative SO2 PSD increment consuming inventory in the region, will not cause or contribute to any violation of the applicable PSD increment.

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APPENDIX A

Hourly Surface Meteorological Observations at Sites Closest to the Jarbidge (Table A-1) and Zion (Table A-2) Class I Areas on Many Days when the CALPUFF-estimated Visibility Impacts Exceed the 5% Change in Extinction over Natural Conditions Threshold using the FLAG approach

Table A-1. Summary of hourly surface meteorological observations at NWS site nearest to the Jarbidge Class I area on most days the CALPUFF-estimated visibility impacts exceed the 5% visibility threshold.

Site	Date	Hour	CeilingH	Rain	Drizzle	Snow	Snow Shower	Ice Pellets	WD	WS	Stn P	T	RH	Sky Cover
24128	1/9/2001	0	14	0	0	0	0	0	0	0	2557	34	100	-
24128	1/9/2001	1	10	0	0	0	0	0	17	4	2556	34	100	-
24128	1/9/2001	2	8	0	0	0	0	0	16	3	2556	34	100	-
24128	1/9/2001	3	8	0	0	0	0	0	9	3	2556	34	100	-
24128	1/9/2001	4	---	0	0	0	0	0	34	3	2554	33	100	-
24128	1/9/2001	5	2	0	0	0	0	0	0	0	2556	34	100	-
24128	1/9/2001	6	4	0	0	0	0	0	0	0	2555	34	100	-
24128	1/9/2001	7	4	0	0	0	0	0	19	4	2555	34	100	-
24128	1/9/2001	8	1	0	0	0	0	0	0	0	2556	34	100	-
24128	1/9/2001	9	3	0	0	0	0	0	18	3	2556	34	100	-
24128	1/9/2001	10	---	0	0	0	0	0	22	3	2555	36	97	-
24128	1/9/2001	11	30	0	0	0	0	0	26	3	2556	37	97	-
24128	1/9/2001	12	30	0	0	0	0	0	19	5	2551	38	97	-
24128	1/9/2001	13	28	0	0	0	0	0	20	4	2550	39	81	-
24128	1/9/2001	14	26	0	0	0	0	0	20	9	2549	39	75	-
24128	1/9/2001	15	31	0	0	0	0	0	19	8	2548	41	70	9
24128	1/9/2001	16	---	0	0	0	0	0	16	9	2543	40	77	8
24128	1/9/2001	17	---	0	0	0	0	0	16	10	2544	37	75	5
24128	1/9/2001	18	89	0	0	0	0	0	18	10	2545	36	81	-
24128	1/9/2001	19	69	0	0	0	0	0	19	9	2549	37	81	-
24128	1/9/2001	20	59	0	0	0	0	0	20	7	2549	36	81	-
24128	1/9/2001	21	79	0	0	0	0	0	18	9	2549	37	75	-
24128	1/9/2001	22	---	0	0	0	0	0	21	4	2548	36	82	-
24128	1/9/2001	23	59	0	0	0	0	0	18	12	2551	36	81	-
24128	1/11/2001	0	49	0	0	0	0	0	13	3	2531	39	61	-
24128	1/11/2001	1	23	1	0	0	0	0	18	7	2532	37	87	-
24128	1/11/2001	2	25	1	0	0	0	0	7	3	2532	36	93	-
24128	1/11/2001	3	17	1	0	0	0	0	8	3	2530	36	93	-
24128	1/11/2001	4	---	0	0	0	0	0	11	6	2527	35	96	-
24128	1/11/2001	5	9	1	0	0	0	0	17	4	2530	36	93	-
24128	1/11/2001	6	5	0	0	1	0	0	34	3	2529	34	100	-
24128	1/11/2001	7	13	0	0	1	0	0	6	5	2530	34	93	-
24128	1/11/2001	8	25	0	0	1	0	0	5	5	2531	34	93	-
24128	1/11/2001	9	15	0	0	1	0	0	21	3	2533	34	93	-
24128	1/11/2001	10	---	0	0	0	0	0	13	6	2530	33	96	-
24128	1/11/2001	11	---	0	0	0	0	0	18	5	2530	33	96	-
24128	1/11/2001	12	---	0	0	0	0	0	18	5	2530	34	96	-
24128	1/11/2001	13	---	0	0	0	0	0	19	6	2534	34	100	5
24128	1/11/2001	14	28	0	0	1	0	0	18	6	2534	36	93	-
24128	1/11/2001	15	35	0	0	0	0	0	17	5	2535	36	93	9
24128	1/11/2001	16	---	0	0	0	0	0	19	8	2534	35	93	3
24128	1/11/2001	17	---	0	0	0	0	0	18	6	2538	34	87	5
24128	1/11/2001	18	---	0	0	0	0	0	17	10	2541	32	93	3
24128	1/11/2001	19	---	0	0	0	0	0	18	12	2542	30	100	0
24128	1/11/2001	20	---	0	0	0	0	0	18	12	2543	30	93	0
24128	1/11/2001	21	---	0	0	0	0	0	19	8	2545	30	86	0
24128	1/11/2001	22	---	0	0	0	0	0	0	0	2543	27	92	0

Site	Date	Hour	CeilingH	Rain	Drizzle	Snow	Snow Shower	Ice Pellets	WD	WS	Stn P	T	RH	Sky Cover
24128	1/11/2001	23	---	0	0	0	0	0	0	0	2547	25	86	0
24128	1/23/2001	0	---	0	0	0	0	0	13	4	2577	18	86	0
24128	1/23/2001	1	---	0	0	0	0	0	11	4	2575	18	93	0
24128	1/23/2001	2	---	0	0	0	0	0	8	9	2573	21	86	0
24128	1/23/2001	3	---	0	0	0	0	0	6	8	2574	23	80	0
24128	1/23/2001	4	---	0	0	0	0	0	10	5	2571	18	84	0
24128	1/23/2001	5	---	0	0	0	0	0	0	0	2574	12	92	0
24128	1/23/2001	6	---	0	0	0	0	0	0	0	2574	14	85	0
24128	1/23/2001	7	---	0	0	0	0	0	10	5	2573	16	86	0
24128	1/23/2001	8	---	0	0	0	0	0	9	5	2573	19	86	0
24128	1/23/2001	9	---	0	0	0	0	0	6	11	2574	25	74	0
24128	1/23/2001	10	---	0	0	0	0	0	6	12	2570	27	72	0
24128	1/23/2001	11	---	0	0	0	0	0	5	11	2573	32	64	0
24128	1/23/2001	12	---	0	0	0	0	0	5	9	2571	34	60	0
24128	1/23/2001	13	---	0	0	0	0	0	6	11	2567	36	56	5
24128	1/23/2001	14	---	0	0	0	0	0	5	14	2565	36	56	5
24128	1/23/2001	15	---	0	0	0	0	0	5	15	2564	36	56	5
24128	1/23/2001	16	---	0	0	0	0	0	6	14	2560	35	59	8
24128	1/23/2001	17	98	0	0	0	0	0	5	15	2562	36	56	-
24128	1/23/2001	18	89	0	0	0	0	0	8	11	2562	36	60	-
24128	1/23/2001	19	98	0	0	0	0	0	6	13	2560	34	70	-
24128	1/23/2001	20	---	0	0	0	0	0	8	8	2559	34	65	3
24128	1/23/2001	21	---	0	0	0	0	0	9	8	2558	30	75	0
24128	1/23/2001	22	---	0	0	0	0	0	9	8	2555	30	75	0
24128	1/23/2001	23	---	0	0	0	0	0	6	12	2556	30	80	0
24128	1/24/2001	0	---	0	0	0	0	0	7	13	2555	30	75	0
24128	1/24/2001	1	---	0	0	0	0	0	6	10	2554	30	75	0
24128	1/24/2001	2	---	0	0	0	0	0	7	9	2554	28	74	0
24128	1/24/2001	3	---	0	0	0	0	0	7	10	2554	30	75	0
24128	1/24/2001	4	---	0	0	0	0	0	6	10	2550	32	69	0
24128	1/24/2001	5	---	0	0	0	0	0	7	7	2552	30	75	0
24128	1/24/2001	6	---	0	0	0	0	0	8	3	2553	27	80	0
24128	1/24/2001	7	---	0	0	0	0	0	4	3	2553	28	80	0
24128	1/24/2001	8	79	0	0	0	0	0	0	0	2554	28	80	-
24128	1/24/2001	9	69	0	0	0	0	0	0	0	2555	30	80	9
24128	1/24/2001	10	---	0	0	0	0	0	30	6	2553	35	67	-
24128	1/24/2001	11	59	0	0	0	0	0	30	4	2556	36	70	9
24128	1/24/2001	12	25	0	0	1	0	0	28	9	2556	34	87	-
24128	1/24/2001	13	4	0	0	1	0	0	27	6	2553	34	100	-
24128	1/24/2001	14	4	0	0	2	0	0	28	8	2552	32	100	-
24128	1/24/2001	15	11	0	0	1	0	0	26	4	2553	34	93	-
24128	1/24/2001	16	---	0	0	0	0	0	28	3	2550	34	92	-
24128	1/24/2001	17	59	0	0	0	0	0	0	0	2553	34	87	-
24128	1/24/2001	18	69	0	0	0	0	0	0	0	2554	34	87	-
24128	1/24/2001	19	48	0	0	0	0	0	0	0	2556	30	100	-
24128	1/24/2001	20	48	0	0	0	0	0	24	4	2556	32	87	9
24128	1/24/2001	21	59	0	0	0	0	0	24	12	2556	34	81	9
24128	1/24/2001	22	---	0	0	0	0	0	25	14	2556	33	82	-
24128	1/24/2001	23	59	0	0	0	0	0	26	11	2560	34	75	-

Site	Date	Hour	CeilingH	Rain	Drizzle	Snow	Snow Shower	Ice Pellets	WD	WS	Stn P	T	RH	Sky Cover
24128	3/4/2001	0	---	0	0	0	0	0	6	9	2550	34	75	5
24128	3/4/2001	1	89	0	0	0	0	0	6	9	2551	34	75	-
24128	3/4/2001	2	98	0	0	0	0	0	8	10	2550	34	75	-
24128	3/4/2001	3	98	0	0	0	0	0	8	11	2549	34	75	-
24128	3/4/2001	4	---	0	0	0	0	0	7	12	2547	34	76	-
24128	3/4/2001	5	89	0	0	0	0	0	8	8	2550	34	70	-
24128	3/4/2001	6	79	0	0	0	0	0	7	10	2549	36	70	-
24128	3/4/2001	7	79	0	0	0	0	0	6	9	2549	36	70	-
24128	3/4/2001	8	79	0	0	0	0	0	8	8	2552	37	65	-
24128	3/4/2001	9	43	0	0	0	0	0	8	4	2552	39	61	-
24128	3/4/2001	10	---	0	0	0	0	0	5	5	2550	41	65	-
24128	3/4/2001	11	48	0	0	0	0	0	17	10	2552	46	53	9
24128	3/4/2001	12	40	0	0	0	0	0	17	8	2551	46	53	-
24128	3/4/2001	13	59	0	0	0	0	0	17	12	2549	50	50	-
24128	3/4/2001	14	---	0	0	0	0	0	15	8	2547	50	50	3
24128	3/4/2001	15	59	0	0	0	0	0	18	10	2548	52	47	-
24128	3/4/2001	16	---	0	0	0	0	0	17	14	2545	50	50	5
24128	3/4/2001	17	---	0	0	0	0	0	16	19	2547	46	62	0
24128	3/4/2001	18	118	0	0	0	0	0	17	12	2547	46	57	9
24128	3/4/2001	19	---	0	0	0	0	0	21	3	2549	45	61	5
24128	3/4/2001	20	---	0	0	0	0	0	21	5	2549	43	61	0
24128	3/4/2001	21	98	0	0	0	0	0	29	8	2551	45	57	9
24128	3/4/2001	22	---	0	0	0	0	0	24	4	2551	43	56	-
24128	3/4/2001	23	108	0	0	0	0	0	22	9	2555	45	49	-
24128	11/5/2001	0	---	0	0	0	0	0	13	4	2574	34	65	0
24128	11/5/2001	1	---	0	0	0	0	0	13	4	2573	28	74	0
24128	11/5/2001	2	---	0	0	0	0	0	8	3	2573	34	70	0
24128	11/5/2001	3	---	0	0	0	0	0	15	4	2572	30	75	0
24128	11/5/2001	4	---	0	0	0	0	0	0	0	2570	29	72	0
24128	11/5/2001	5	---	0	0	0	0	0	1	3	2574	27	74	0
24128	11/5/2001	6	---	0	0	0	0	0	36	2	2575	25	74	0
24128	11/5/2001	7	---	0	0	0	0	0	35	3	2576	25	80	0
24128	11/5/2001	8	---	0	0	0	0	0	34	2	2578	37	60	0
24128	11/5/2001	9	---	0	0	0	0	0	34	2	2578	48	46	0
24128	11/5/2001	10	---	0	0	0	0	0	0	0	2573	56	37	0
24128	11/5/2001	11	---	0	0	0	0	0	30	4	2574	63	30	0
24128	11/5/2001	12	---	0	0	0	0	0	30	5	2571	64	30	0
24128	11/5/2001	13	---	0	0	0	0	0	29	8	2570	66	28	0
24128	11/5/2001	14	---	0	0	0	0	0	26	4	2568	66	28	0
24128	11/5/2001	15	---	0	0	0	0	0	35	3	2567	68	24	0
24128	11/5/2001	16	---	0	0	0	0	0	36	3	2564	67	26	0
24128	11/5/2001	17	---	0	0	0	0	0	34	6	2566	57	33	0
24128	11/5/2001	18	---	0	0	0	0	0	24	3	2566	46	46	0
24128	11/5/2001	19	---	0	0	0	0	0	15	5	2565	48	43	0
24128	11/5/2001	20	---	0	0	0	0	0	15	5	2565	41	53	0
24128	11/5/2001	21	---	0	0	0	0	0	13	5	2565	36	60	0
24128	11/5/2001	22	---	0	0	0	0	0	12	7	2564	36	64	0
24128	11/5/2001	23	---	0	0	0	0	0	12	5	2565	36	65	0
24128	11/6/2001	0	---	0	0	0	0	0	11	4	2564	41	57	0

Site	Date	Hour	CeilingH	Rain	Drizzle	Snow	Snow Shower	Ice Pellets	WD	WS	Stn P	T	RH	Sky Cover
24128	11/6/2001	1	---	0	0	0	0	0	12	5	2564	28	74	0
24128	11/6/2001	2	---	0	0	0	0	0	13	3	2564	28	74	0
24128	11/6/2001	3	---	0	0	0	0	0	15	5	2562	30	75	3
24128	11/6/2001	4	---	0	0	0	0	0	0	0	2558	30	72	0
24128	11/6/2001	5	---	0	0	0	0	0	22	3	2561	28	74	0
24128	11/6/2001	6	---	0	0	0	0	0	20	3	2561	25	80	0
24128	11/6/2001	7	---	0	0	0	0	0	25	3	2562	27	80	0
24128	11/6/2001	8	---	0	0	0	0	0	26	3	2564	36	65	0
24128	11/6/2001	9	---	0	0	0	0	0	35	4	2564	46	50	0
24128	11/6/2001	10	---	0	0	0	0	0	30	4	2560	58	36	0
24128	11/6/2001	11	---	0	0	0	0	0	27	4	2562	63	30	0
24128	11/6/2001	12	---	0	0	0	0	0	21	10	2560	70	21	0
24128	11/6/2001	13	---	0	0	0	0	0	23	11	2559	66	21	3
24128	11/6/2001	14	---	0	0	0	0	0	24	14	2559	66	21	5
24128	11/6/2001	15	98	0	0	0	0	0	29	10	2560	64	22	9
24128	11/6/2001	16	---	0	0	0	0	0	31	9	2557	64	23	0
24128	11/6/2001	17	---	0	0	0	0	0	32	5	2561	55	31	0
24128	11/6/2001	18	108	0	0	0	0	0	33	3	2563	54	33	9
24128	11/6/2001	19	---	0	0	0	0	0	33	8	2564	50	35	3
24128	11/6/2001	20	---	0	0	0	0	0	32	9	2566	48	43	3
24128	11/6/2001	21	---	0	0	0	0	0	33	14	2569	48	46	3
24128	11/6/2001	22	---	0	0	0	0	0	33	3	2570	42	53	0
24128	11/6/2001	23	---	0	0	0	0	0	33	9	2575	43	61	0
24128	11/10/2001	0	---	0	0	0	0	0	16	6	2581	25	50	0
24128	11/10/2001	1	---	0	0	0	0	0	11	5	2581	23	54	0
24128	11/10/2001	2	---	0	0	0	0	0	15	6	2582	19	63	0
24128	11/10/2001	3	---	0	0	0	0	0	15	6	2581	16	57	0
24128	11/10/2001	4	---	0	0	0	0	0	18	5	2578	14	64	0
24128	11/10/2001	5	---	0	0	0	0	0	14	7	2581	18	62	0
24128	11/10/2001	6	---	0	0	0	0	0	14	6	2581	18	62	0
24128	11/10/2001	7	---	0	0	0	0	0	15	4	2583	19	63	0
24128	11/10/2001	8	---	0	0	0	0	0	10	6	2584	30	43	0
24128	11/10/2001	9	---	0	0	0	0	0	7	7	2583	43	34	0
24128	11/10/2001	10	---	0	0	0	0	0	5	9	2579	49	28	0
24128	11/10/2001	11	---	0	0	0	0	0	5	8	2580	52	26	0
24128	11/10/2001	12	---	0	0	0	0	0	5	6	2578	57	25	0
24128	11/10/2001	13	---	0	0	0	0	0	36	3	2576	61	22	0
24128	11/10/2001	14	---	0	0	0	0	0	36	4	2574	61	20	0
24128	11/10/2001	15	---	0	0	0	0	0	36	4	2573	61	22	0
24128	11/10/2001	16	---	0	0	0	0	0	31	4	2570	58	23	0
24128	11/10/2001	17	---	0	0	0	0	0	31	4	2571	50	28	0
24128	11/10/2001	18	---	0	0	0	0	0	6	5	2571	41	36	0
24128	11/10/2001	19	---	0	0	0	0	0	11	4	2571	34	41	0
24128	11/10/2001	20	---	0	0	0	0	0	14	7	2571	36	44	0
24128	11/10/2001	21	---	0	0	0	0	0	15	5	2570	32	47	0
24128	11/10/2001	22	---	0	0	0	0	0	8	8	2566	43	37	0
24128	11/10/2001	23	---	0	0	0	0	0	12	8	2569	36	48	0
24128	11/11/2001	0	---	0	0	0	0	0	14	7	2568	32	51	0
24128	11/11/2001	1	---	0	0	0	0	0	11	7	2567	36	48	0

Site	Date	Hour	CeilingH	Rain	Drizzle	Snow	Snow Shower	Ice Pellets	WD	WS	Stn P	T	RH	Sky Cover
24128	11/11/2001	2	---	0	0	0	0	0	12	7	2566	28	59	0
24128	11/11/2001	3	---	0	0	0	0	0	13	7	2565	28	59	0
24128	11/11/2001	4	---	0	0	0	0	0	9	8	2563	38	48	5
24128	11/11/2001	5	118	0	0	0	0	0	14	3	2565	36	52	-
24128	11/11/2001	6	98	0	0	0	0	0	9	5	2566	34	51	-
24128	11/11/2001	7	47	1	0	0	0	0	11	6	2568	36	60	-
24128	11/11/2001	8	47	1	0	0	0	0	8	9	2570	36	81	-
24128	11/11/2001	9	79	0	0	0	0	0	5	11	2569	43	57	9
24128	11/11/2001	10	---	0	0	0	0	0	6	12	2567	45	58	0
24128	11/11/2001	11	---	0	0	0	0	0	6	14	2569	48	58	0
24128	11/11/2001	12	---	0	0	0	0	0	5	11	2567	55	48	0
24128	11/11/2001	13	---	0	0	0	0	0	5	4	2564	59	45	0
24128	11/11/2001	14	89	0	0	0	0	0	4	7	2564	61	42	9
24128	11/11/2001	15	---	0	0	0	0	0	4	4	2564	59	42	3
24128	11/11/2001	16	---	0	0	0	0	0	5	7	2561	58	44	-
24128	11/11/2001	17	---	0	0	0	0	0	7	7	2564	52	54	5
24128	11/11/2001	18	79	0	0	0	0	0	7	10	2565	52	54	9
24128	11/11/2001	19	98	0	0	0	0	0	6	8	2566	52	54	-
24128	11/11/2001	20	---	0	0	0	0	0	11	5	2566	46	62	0
24128	11/11/2001	21	---	0	0	0	0	0	16	7	2567	41	70	0
24128	11/11/2001	22	---	0	0	0	0	0	14	3	2565	41	70	5
24128	11/11/2001	23	69	0	0	0	0	0	13	4	2568	39	70	9
24128	11/12/2001	0	---	0	0	0	0	0	9	3	2568	37	75	3
24128	11/12/2001	1	---	0	0	0	0	0	11	4	2567	34	75	0
24128	11/12/2001	2	---	0	0	0	0	0	11	3	2566	34	81	0
24128	11/12/2001	3	---	0	0	0	0	0	13	5	2565	36	75	0
24128	11/12/2001	4	---	0	0	0	0	0	11	6	2562	35	76	0
24128	11/12/2001	5	---	0	0	0	0	0	6	8	2563	41	76	0
24128	11/12/2001	6	---	0	0	0	0	0	7	9	2562	39	81	0
24128	11/12/2001	7	---	0	0	0	0	0	7	11	2561	39	81	0
24128	11/12/2001	8	---	0	0	0	0	0	7	4	2561	43	71	0
24128	11/12/2001	9	---	0	0	0	0	0	6	9	2560	46	62	0
24128	11/12/2001	10	---	0	0	0	0	0	6	9	2556	52	55	0
24128	11/12/2001	11	---	0	0	0	0	0	8	5	2557	55	48	0
24128	11/12/2001	12	---	0	0	0	0	0	4	7	2553	59	45	0
24128	11/12/2001	13	---	0	0	0	0	0	5	5	2549	61	42	0
24128	11/12/2001	14	---	0	0	0	0	0	3	6	2546	63	37	0
24128	11/12/2001	15	---	0	0	0	0	0	15	7	2543	63	34	0
24128	11/12/2001	16	---	0	0	0	0	0	4	4	2540	60	38	0
24128	11/12/2001	17	---	0	0	0	0	0	4	3	2540	55	48	0
24128	11/12/2001	18	---	0	0	0	0	0	5	10	2541	55	48	0
24128	11/12/2001	19	89	0	0	0	0	0	27	18	2544	48	66	9
24128	11/12/2001	20	108	0	0	0	0	0	28	24	2546	46	71	-
24128	11/12/2001	21	79	1	0	0	0	0	30	10	2550	45	81	-
24128	11/12/2001	22	---	0	0	0	0	0	27	9	2549	44	85	-
24128	11/12/2001	23	59	0	0	0	0	0	19	4	2550	43	87	-
24128	12/29/2001	0	89	0	0	0	0	0	9	3	2560	34	81	-
24128	12/29/2001	1	59	0	0	0	0	0	13	3	2559	34	87	-
24128	12/29/2001	2	69	0	0	0	0	0	27	3	2559	32	93	-

Site	Date	Hour	CeilingH	Rain	Drizzle	Snow	Snow Shower	Ice Pellets	WD	WS	Stn P	T	RH	Sky Cover
24128	12/29/2001	3	49	0	0	0	0	0	12	5	2559	34	87	-
24128	12/29/2001	4	---	0	0	0	0	0	6	5	2556	33	92	-
24128	12/29/2001	5	24	0	0	1	0	0	6	6	2556	34	92	9
24128	12/29/2001	6	22	0	0	1	0	0	5	7	2559	34	87	-
24128	12/29/2001	7	31	0	0	1	0	0	6	8	2560	34	87	-
24128	12/29/2001	8	28	0	0	0	0	0	7	9	2562	34	93	-
24128	12/29/2001	9	20	0	0	0	0	0	6	9	2563	34	93	-
24128	12/29/2001	10	---	0	0	0	0	0	7	8	2561	34	92	-
24128	12/29/2001	11	---	0	0	0	0	0	7	8	2561	35	92	-
24128	12/29/2001	12	8	0	0	0	0	0	6	7	2561	36	93	-
24128	12/29/2001	13	6	0	0	0	0	0	7	8	2561	36	100	-
24128	12/29/2001	14	17	0	0	0	0	0	5	5	2561	37	93	-
24128	12/29/2001	15	15	0	0	0	0	0	6	7	2561	36	100	-
24128	12/29/2001	16	---	0	0	0	0	0	5	5	2559	36	97	-
24128	12/29/2001	17	13	0	0	0	0	0	5	5	2563	36	93	-
24128	12/29/2001	18	8	0	0	0	0	0	4	5	2564	36	93	-
24128	12/29/2001	19	15	0	0	0	0	0	4	3	2565	34	100	-
24128	12/29/2001	20	1	0	0	0	0	0	4	3	2566	34	100	-
24128	12/29/2001	21	11	0	0	0	0	0	4	3	2566	34	100	-
24128	12/29/2001	22	---	0	0	0	0	0	0	0	2564	34	100	-
24128	12/29/2001	23	3	0	0	0	0	0			2567	34	100	-
24128	12/30/2001	0	24	0	0	0	0	0			2568	34	100	-
24128	12/30/2001	1	19	0	0	0	0	0			2570	34	100	-
24128	12/30/2001	2	26	0	0	0	0	0			2571	34	100	-
24128	12/30/2001	3	26	0	0	0	0	0			2571			-
24128	12/30/2001	4	---	0	0	0	0	0	9	5	2567			-
24128	12/30/2001	5	---	0	0	0	0	0			2567			-
24128	12/30/2001	6	---	0	0	0	0	0			2567			-
24128	12/30/2001	7	---	0	0	0	0	0			2567			-
24128	12/30/2001	8	1	0	0	0	0	0			2572			-
24128	12/30/2001	9	1	0	0	0	0	0			2572			-
24128	12/30/2001	10	---	0	0	0	0	0	5	3	2572	38	97	-
24128	12/30/2001	11	3	0	0	0	0	0	6	5	2575	39	93	-
24128	12/30/2001	12	10	0	0	0	0	0	6	5	2571	39	93	-
24128	12/30/2001	13	---	0	0	0	0	0	4	4	2568	43	87	0
24128	12/30/2001	14	21	0	0	0	0	0	5	7	2566	41	93	-
24128	12/30/2001	15	49	0	0	0	0	0	4	8	2567	41	93	-
24128	12/30/2001	16	---	0	0	0	0	0	4	8	2564	39	96	-
24128	12/30/2001	17	22	0	0	0	0	0	5	8	2565	37	100	-
24128	12/30/2001	18	59	0	0	0	0	0	6	9	2564	37	100	-
24128	12/30/2001	19	49	0	0	0	0	0	6	9	2563	37	93	-
24128	12/30/2001	20	47	0	0	0	0	0	7	9	2561	36	100	-
24128	12/30/2001	21	49	0	0	0	0	0	7	8	2560	36	100	-
24128	12/30/2001	22	---	0	0	0	0	0	7	8	2557	36	97	-
24128	12/30/2001	23	37	1	0	0	0	0	7	7	2562	37	93	-
24128	1/2/2002	0	---	0	0	0	0	0	7	8	2569	36	93	3
24128	1/2/2002	1	---	0	0	0	0	0	4	12	2567	37	87	0
24128	1/2/2002	2	---	0	0	0	0	0	7	8	2568	37	87	5
24128	1/2/2002	3	118	0	0	0	0	0	7	9	2568	36	93	-

Site	Date	Hour	CeilingH	Rain	Drizzle	Snow	Snow Shower	Ice Pellets	WD	WS	Stn P	T	RH	Sky Cover
24128	1/2/2002	4	---	0	0	0	0	0	7	6	2565	37	89	-
24128	1/2/2002	5	79	0	0	0	0	0	7	9	2567	36	93	-
24128	1/2/2002	6	79	0	0	0	0	0	7	7	2568	36	93	9
24128	1/2/2002	7	79	0	0	0	0	0	7	9	2568	36	93	9
24128	1/2/2002	8	69	0	0	0	0	0	9	6	2568	36	93	-
24128	1/2/2002	9	79	0	0	0	0	0	15	7	2570	37	93	-
24128	1/2/2002	10	---	0	0	0	0	0	19	10	2567	41	82	8
24128	1/2/2002	11	69	0	0	0	0	0	12	7	2569	43	81	-
24128	1/2/2002	12	79	0	0	0	0	0	8	6	2566	45	76	9
24128	1/2/2002	13	59	0	0	0	0	0	7	5	2565	43	76	-
24128	1/2/2002	14	69	0	0	0	0	0	7	8	2564	45	76	-
24128	1/2/2002	15	59	0	0	0	0	0	7	6	2564	45	76	-
24128	1/2/2002	16	---	0	0	0	0	0	6	6	2561	43	80	-
24128	1/2/2002	17	59	0	0	0	0	0	6	8	2564	43	81	-
24128	1/2/2002	18	69	0	0	0	0	0	5	8	2563	39	93	9
24128	1/2/2002	19	45	0	0	0	0	0	6	9	2563	39	93	-
24128	1/2/2002	20	49	0	0	0	0	0	6	7	2563	39	93	-
24128	1/2/2002	21	31	2	0	0	0	0	12	9	2566	39	93	-
24128	1/2/2002	22	---	0	0	0	0	0	22	6	2565	37	93	-
24128	1/2/2002	23	33	1	0	0	0	0	16	12	2565	37	93	-
24128	2/16/2002	0	---	0	0	0	0	0	6	11	2577	36	56	0
24128	2/16/2002	1	---	0	0	0	0	0	7	9	2576	34	60	0
24128	2/16/2002	2	---	0	0	0	0	0	11	7	2576	30	69	0
24128	2/16/2002	3	---	0	0	0	0	0	7	11	2574	32	64	0
24128	2/16/2002	4	---	0	0	0	0	0	6	11	2570	31	67	0
24128	2/16/2002	5	---	0	0	0	0	0	7	12	2572	30	69	0
24128	2/16/2002	6	---	0	0	0	0	0	7	13	2573	32	64	0
24128	2/16/2002	7	---	0	0	0	0	0	8	10	2573	32	64	0
24128	2/16/2002	8	---	0	0	0	0	0	7	10	2573	34	65	0
24128	2/16/2002	9	---	0	0	0	0	0	6	11	2571	37	60	0
24128	2/16/2002	10	---	0	0	0	0	0	7	12	2568	43	49	0
24128	2/16/2002	11	---	0	0	0	0	0	6	12	2569	48	40	0
24128	2/16/2002	12	---	0	0	0	0	0	5	8	2565	50	37	0
24128	2/16/2002	13	---	0	0	0	0	0	4	6	2562	52	35	0
24128	2/16/2002	14	---	0	0	0	0	0	4	5	2558	54	33	0
24128	2/16/2002	15	---	0	0	0	0	0	3	12	2556	54	33	0
24128	2/16/2002	16	---	0	0	0	0	0	2	7	2552	54	33	0
24128	2/16/2002	17	---	0	0	0	0	0	3	9	2553	50	37	3
24128	2/16/2002	18	---	0	0	0	0	0	5	8	2551	45	46	0
24128	2/16/2002	19	---	0	0	0	0	0	5	9	2551	44	46	0
24128	2/16/2002	20	---	0	0	0	0	0	6	9	2549	43	49	3
24128	2/16/2002	21	---	0	0	0	0	0	6	11	2548	41	57	3
24128	2/16/2002	22	---	0	0	0	0	0	6	13	2543	39	60	3
24128	2/16/2002	23	98	0	0	0	0	0	12	6	2546	36	65	-
24128	9/16/2002	0	59	0	0	0	0	0	33	14	2566	57	72	-
24128	9/16/2002	1	49	0	0	0	0	0	35	9	2568	54	94	-
24128	9/16/2002	2	69	1	0	0	0	0	1	10	2566	54	88	-
24128	9/16/2002	3	39	2	0	0	0	0	8	14	2564	52	88	-
24128	9/16/2002	4	---	0	0	0	0	0	5	10	2556	53	83	-

Site	Date	Hour	CeilingH	Rain	Drizzle	Snow	Snow Shower	Ice Pellets	WD	WS	Stn P	T	RH	Sky Cover
24128	9/16/2002	5	---	0	0	0	0	0	6	7	2560	52	88	5
24128	9/16/2002	6	---	0	0	0	0	0	7	7	2562	52	88	0
24128	9/16/2002	7	---	0	0	0	0	0	5	5	2563	54	88	0
24128	9/16/2002	8	---	0	0	0	0	0	4	5	2563	58	88	0
24128	9/16/2002	9	---	0	0	0	0	0	4	3	2563	61	63	0
24128	9/16/2002	10	---	0	0	0	0	0	21	6	2560	64	56	8
24128	9/16/2002	11	41	0	0	0	0	0	28	8	2564	64	56	-
24128	9/16/2002	12	---	0	0	0	0	0	29	10	2563	68	46	3
24128	9/16/2002	13	---	0	0	0	0	0	27	11	2562	72	41	3
24128	9/16/2002	14	---	0	0	0	0	0	28	5	2560	72	38	3
24128	9/16/2002	15	---	0	0	0	0	0	27	12	2560	72	33	0
24128	9/16/2002	16	---	0	0	0	0	0	27	10	2557	72	31	0
24128	9/16/2002	17	---	0	0	0	0	0	26	4	2558	70	35	0
24128	9/16/2002	18	---	0	0	0	0	0	28	3	2558	64	46	0
24128	9/16/2002	19	---	0	0	0	0	0	14	4	2558	57	67	0
24128	9/16/2002	20	---	0	0	0	0	0	16	6	2558	54	77	0
24128	9/16/2002	21	---	0	0	0	0	0	16	7	2559	52	77	0
24128	9/16/2002	22	---	0	0	0	0	0	22	5	2556	53	72	0
24128	9/16/2002	23	---	0	0	0	0	0	13	4	2558	52	72	0
24128	11/21/2002	0	---	0	0	0	0	0	10	9	2594	43	76	0
24128	11/21/2002	1	---	0	0	0	0	0	15	5	2593	36	81	0
24128	11/21/2002	2	---	0	0	0	0	0	13	5	2593	34	87	0
24128	11/21/2002	3	---	0	0	0	0	0	14	7	2593	30	93	0
24128	11/21/2002	4	---	0	0	0	0	0	14	7	2590	32	88	0
24128	11/21/2002	5	---	0	0	0	0	0	15	5	2591	30	93	0
24128	11/21/2002	6	---	0	0	0	0	0	1	3	2591	32	87	0
24128	11/21/2002	7	---	0	0	0	0	0	0	0	2592	28	93	0
24128	11/21/2002	8	---	0	0	0	0	0	0	0	2592	36	87	0
24128	11/21/2002	9	---	0	0	0	0	0	0	0	2593	45	71	0
24128	11/21/2002	10	---	0	0	0	0	0	6	4	2589	52	57	0
24128	11/21/2002	11	---	0	0	0	0	0	5	3	2589	55	57	0
24128	11/21/2002	12	---	0	0	0	0	0	7	5	2586	57	48	0
24128	11/21/2002	13	---	0	0	0	0	0	6	4	2585	61	42	0
24128	11/21/2002	14	---	0	0	0	0	0	5	4	2583	63	39	0
24128	11/21/2002	15	---	0	0	0	0	0	5	3	2583	63	39	0
24128	11/21/2002	16	---	0	0	0	0	0	3	3	2579	60	42	0
24128	11/21/2002	17	---	0	0	0	0	0	5	5	2583	52	54	0
24128	11/21/2002	18	---	0	0	0	0	0	32	6	2584	43	71	0
24128	11/21/2002	19	---	0	0	0	0	0	0	0	2583	43	76	0
24128	11/21/2002	20	---	0	0	0	0	0	12	4	2583	36	81	0
24128	11/21/2002	21	---	0	0	0	0	0	15	6	2584	36	81	0
24128	11/21/2002	22	---	0	0	0	0	0	13	8	2580	36	82	0
24128	11/21/2002	23	---	0	0	0	0	0	17	9	2583	36	81	0
24128	11/30/2002	0	---	0	0	0	0	0	15	5	2578	21	86	0
24128	11/30/2002	1	---	0	0	0	0	0	0	0	2578	19	86	0
24128	11/30/2002	2	---	0	0	0	0	0	15	6	2579	19	86	0
24128	11/30/2002	3	---	0	0	0	0	0	17	3	2578	21	86	0
24128	11/30/2002	4	---	0	0	0	0	0	28	6	2573	17	92	0
24128	11/30/2002	5	---	0	0	0	0	0	0	0	2576	19	93	0

Site	Date	Hour	CeilingH	Rain	Drizzle	Snow	Snow Shower	Ice Pellets	WD	WS	Stn P	T	RH	Sky Cover
24128	11/30/2002	6	---	0	0	0	0	0	14	3	2576	18	86	0
24128	11/30/2002	7	---	0	0	0	0	0	15	6	2576	18	93	0
24128	11/30/2002	8	---	0	0	0	0	0	0	0	2577	21	86	0
24128	11/30/2002	9	---	0	0	0	0	0	0	0	2577	32	75	0
24128	11/30/2002	10	---	0	0	0	0	0	3	7	2573	42	58	0
24128	11/30/2002	11	---	0	0	0	0	0	3	10	2574	45	53	0
24128	11/30/2002	12	---	0	0	0	0	0	0	0	2572	48	46	0
24128	11/30/2002	13	---	0	0	0	0	0	36	5	2571	52	44	0
24128	11/30/2002	14	---	0	0	0	0	0	0	0	2571	52	41	0
24128	11/30/2002	15	---	0	0	0	0	0	26	4	2571	54	38	0
24128	11/30/2002	16	---	0	0	0	0	0	28	6	2568	49	45	0
24128	11/30/2002	17	---	0	0	0	0	0	14	6	2571	41	57	0
24128	11/30/2002	18	98	0	0	0	0	0	0	0	2572	39	61	9
24128	11/30/2002	19	98	0	0	0	0	0	0	0	2574	36	65	-
24128	11/30/2002	20	98	0	0	0	0	0	19	4	2574	36	65	-
24128	11/30/2002	21	108	0	0	0	0	0	17	3	2575	34	70	-
24128	11/30/2002	22	---	0	0	0	0	0	0	0	2573	31	76	8
24128	11/30/2002	23	108	0	0	0	0	0	0	0	2577	30	80	9
24128	12/6/2002	0	---	0	0	0	0	0	14	6	2581	27	80	0
24128	12/6/2002	1	---	0	0	0	0	0	15	3	2581	28	74	0
24128	12/6/2002	2	---	0	0	0	0	0	13	7	2580	27	80	0
24128	12/6/2002	3	---	0	0	0	0	0	8	8	2579	34	70	0
24128	12/6/2002	4	---	0	0	0	0	0	6	12	2576	34	67	0
24128	12/6/2002	5	---	0	0	0	0	0	6	12	2577	34	70	0
24128	12/6/2002	6	---	0	0	0	0	0	7	10	2577	34	70	0
24128	12/6/2002	7	---	0	0	0	0	0	9	8	2578	32	75	0
24128	12/6/2002	8	---	0	0	0	0	0	7	7	2578	34	70	0
24128	12/6/2002	9	---	0	0	0	0	0	7	8	2578	36	65	0
24128	12/6/2002	10	---	0	0	0	0	0	6	9	2575	41	53	0
24128	12/6/2002	11	---	0	0	0	0	0	6	8	2577	43	53	0
24128	12/6/2002	12	---	0	0	0	0	0	6	8	2573	46	46	0
24128	12/6/2002	13	---	0	0	0	0	0	5	10	2571	46	46	0
24128	12/6/2002	14	---	0	0	0	0	0	5	12	2569	46	43	0
24128	12/6/2002	15	---	0	0	0	0	0	4	8	2569	46	43	0
24128	12/6/2002	16	---	0	0	0	0	0	5	7	2566	45	46	0
24128	12/6/2002	17	---	0	0	0	0	0	6	9	2568	39	56	0
24128	12/6/2002	18	---	0	0	0	0	0	4	5	2568	37	60	0
24128	12/6/2002	19	---	0	0	0	0	0	0	0	2569	34	60	0
24128	12/6/2002	20	---	0	0	0	0	0	0	0	2571	30	69	0
24128	12/6/2002	21	---	0	0	0	0	0	0	0	2571	28	74	0
24128	12/6/2002	22	---	0	0	0	0	0	14	3	2570	21	88	0
24128	12/6/2002	23	---	0	0	0	0	0	0	0	2572	23	80	0
24128	12/7/2002	0	---	0	0	0	0	0	15	5	2572	19	93	0
24128	12/7/2002	1	---	0	0	0	0	0	0	0	2572	21	86	0
24128	12/7/2002	2	---	0	0	0	0	0	14	6	2573	18	93	0
24128	12/7/2002	3	---	0	0	0	0	0	13	4	2573	18	86	0
24128	12/7/2002	4	---	0	0	0	0	0	0	0	2571	15	88	0
24128	12/7/2002	5	---	0	0	0	0	0	0	0	2575	18	86	0
24128	12/7/2002	6	---	0	0	0	0	0	0	0	2576	12	92	0

Site	Date	Hour	CeilingH	Rain	Drizzle	Snow	Snow Shower	Ice Pellets	WD	WS	Stn P	T	RH	Sky Cover
24128	12/7/2002	7	---	0	0	0	0	0	0	0	2578	14	85	0
24128	12/7/2002	8	---	0	0	0	0	0	15	5	2579	18	86	0
24128	12/7/2002	9	---	0	0	0	0	0	0	0	2581	28	74	0
24128	12/7/2002	10	---	0	0	0	0	0	0	0	2579	34	67	0
24128	12/7/2002	11	---	0	0	0	0	0	5	5	2582	41	53	0
24128	12/7/2002	12	---	0	0	0	0	0	35	5	2581	45	49	0
24128	12/7/2002	13	---	0	0	0	0	0	0	4	2581	47	49	0
24128	12/7/2002	14	---	0	0	0	0	0	34	6	2579	48	40	0
24128	12/7/2002	15	---	0	0	0	0	0	0	0	2579	48	40	0
24128	12/7/2002	16	---	0	0	0	0	0	32	5	2578	46	42	0
24128	12/7/2002	17	---	0	0	0	0	0	30	4	2581	34	56	0
24128	12/7/2002	18	---	0	0	0	0	0	30	5	2583	30	64	0
24128	12/7/2002	19	---	0	0	0	0	0	17	5	2584	19	79	0
24128	12/7/2002	20	---	0	0	0	0	0	16	5	2585	23	80	0
24128	12/7/2002	21	---	0	0	0	0	0	11	5	2586	21	80	0
24128	12/7/2002	22	---	0	0	0	0	0	0	0	2585	20	81	0
24128	12/7/2002	23	---	0	0	0	0	0	15	7	2590	16	86	0
24128	12/9/2002	0	---	0	0	0	0	0	0	0	2584	21	80	0
24128	12/9/2002	1	---	0	0	0	0	0	10	3	2583	16	79	0
24128	12/9/2002	2	---	0	0	0	0	0	13	6	2582	18	86	0
24128	12/9/2002	3	---	0	0	0	0	0	14	3	2581	18	86	0
24128	12/9/2002	4	---	0	0	0	0	0	0	0	2578	20	81	0
24128	12/9/2002	5	---	0	0	0	0	0	0	0	2580	18	86	0
24128	12/9/2002	6	---	0	0	0	0	0	13	3	2580	16	86	0
24128	12/9/2002	7	---	0	0	0	0	0	0	0	2580	18	79	0
24128	12/9/2002	8	---	0	0	0	0	0	11	6	2580	21	86	0
24128	12/9/2002	9	---	0	0	0	0	0	6	9	2579	32	64	0
24128	12/9/2002	10	---	0	0	0	0	0	7	8	2577	35	57	0
24128	12/9/2002	11	---	0	0	0	0	0	7	6	2578	37	52	0
24128	12/9/2002	12	---	0	0	0	0	0	6	6	2576	39	52	0
24128	12/9/2002	13	---	0	0	0	0	0	5	6	2574	43	42	0
24128	12/9/2002	14	---	0	0	0	0	0	5	5	2574	43	42	0
24128	12/9/2002	15	---	0	0	0	0	0	5	5	2574	42	42	0
24128	12/9/2002	16	---	0	0	0	0	0	6	3	2570	42	43	5
24128	12/9/2002	17	89	0	0	0	0	0	4	4	2573	39	49	-
24128	12/9/2002	18	98	0	0	0	0	0	0	0	2572	36	56	-
24128	12/9/2002	19	108	0	0	0	0	0	23	5	2573	34	56	-
24128	12/9/2002	20	89	0	0	0	0	0	0	0	2572	34	60	-
24128	12/9/2002	21	79	0	0	0	0	0	28	3	2573	32	64	-
24128	12/9/2002	22	---	0	0	0	0	0	0	0	2570	33	64	-
24128	12/9/2002	23	69	0	0	0	0	0	0	0	2570	32	64	9
24128	2/4/1996	0	55	0	0	0	0	0	6	13	2576	26	75	-
24128	2/4/1996	1	100	0	0	0	0	0	5	16	2575	25	81	-
24128	2/4/1996	2	55	0	0	0	0	0	6	12	2575	26	75	-
24128	2/4/1996	3	49	0	0	0	0	0	6	12	2575	27	75	-
24128	2/4/1996	4	47	0	0	0	0	0	6	13	2575	26	78	-
24128	2/4/1996	5	65	1	0	0	0	0	5	9	2574	27	78	-
24128	2/4/1996	6	48	1	0	0	0	0	5	7	2574	28	82	-
24128	2/4/1996	7	48	0	0	1	0	0	6	10	2574	28	85	-

Site	Date	Hour	CeilingH	Rain	Drizzle	Snow	Snow Shower	Ice Pellets	WD	WS	Stn P	T	RH	Sky Cover
24128	2/4/1996	8	47	1	0	0	0	0	6	9	2575	29	92	-
24128	2/4/1996	9	41	1	0	0	0	0	6	12	2575	30	89	-
24128	2/4/1996	10	19	1	0	0	0	0	5	10	2576	30	92	-
24128	2/4/1996	11	36	1	0	0	0	0	5	10	2578	31	96	-
24128	2/4/1996	12	7	1	0	0	0	0	6	8	2575	32	92	-
24128	2/4/1996	13	7	1	0	0	0	0	6	8	2575	32	96	-
24128	2/4/1996	14	28	1	0	0	0	0	4	4	2575	33	96	-
24128	2/4/1996	15	7	1	0	0	0	0	8	7	2575	33	96	-
24128	2/4/1996	16	7	1	0	0	0	0	5	6	2576	33	96	-
24128	2/4/1996	17	32	1	0	0	0	0	6	7	2575	33	96	-
24128	2/4/1996	18	65	0	0	0	0	0	7	7	2576	33	96	7
24128	2/4/1996	19	55	0	0	0	0	0	5	7	2577	33	100	-
24128	2/4/1996	20	---	0	0	0	0	0	5	5	2576	33	96	0
24128	2/4/1996	21	60	0	0	0	0	0	5	13	2575	33	100	7
24128	2/4/1996	22	---	0	0	0	0	0	5	14	2576	33	100	3
24128	2/4/1996	23	---	0	0	0	0	0	7	10	2578	34	96	3
24128	2/17/1996	0	---	0	0	0	0	0	11	3	2568	38	89	0
24128	2/17/1996	1	---	0	0	0	0	0	17	4	2567	40	82	0
24128	2/17/1996	2	---	0	0	0	0	0	8	9	2565	41	83	0
24128	2/17/1996	3	---	0	0	0	0	0	7	4	2564	41	79	0
24128	2/17/1996	4	---	0	0	0	0	0	8	8	2564	41	83	0
24128	2/17/1996	5	---	0	0	0	0	0	15	3	2564	34	92	0
24128	2/17/1996	6	---	0	0	0	0	0	21	3	2563	33	92	0
24128	2/17/1996	7	---	0	0	0	0	0	11	3	2565	31	96	0
24128	2/17/1996	8	110	0	0	0	0	0	0	0	2566	34	92	7
24128	2/17/1996	9	---	0	0	0	0	0	0	0	2566	43	80	0
24128	2/17/1996	10	100	0	0	0	0	0	0	0	2565	50	64	7
24128	2/17/1996	11	65	0	0	0	0	0	19	10	2564	56	53	-
24128	2/17/1996	12	60	0	0	0	0	0	28	11	2564	57	51	-
24128	2/17/1996	13	65	0	0	0	0	0	28	9	2562	57	49	7
24128	2/17/1996	14	85	0	0	0	0	0	24	12	2560	55	51	7
24128	2/17/1996	15	---	0	0	0	0	0	30	12	2561	52	61	0
24128	2/17/1996	16	47	1	0	0	0	0	26	6	2561	49	69	-
24128	2/17/1996	17	65	0	0	0	0	0	27	7	2562	48	74	7
24128	2/17/1996	18	95	0	0	0	0	0	20	6	2561	44	89	7
24128	2/17/1996	19	75	0	0	0	0	0	20	6	2563	46	74	7
24128	2/17/1996	20	---	0	0	0	0	0	21	6	2563	44	77	0
24128	2/17/1996	21	100	0	0	0	0	0	10	5	2564	44	74	7
24128	2/17/1996	22	60	0	0	0	0	0	16	5	2564	42	79	-
24128	2/17/1996	23	60	0	0	0	0	0	20	5	2564	40	86	7
24128	6/26/1996	0	---	0	0	0	0	0	31	5	2547	51	69	0
24128	6/26/1996	1	---	0	0	0	0	0	30	4	2546	49	77	0
24128	6/26/1996	2	110	0	0	0	0	0	0	0	2546	49	77	7
24128	6/26/1996	3	---	0	0	0	0	0	0	0	2544	49	74	3
24128	6/26/1996	4	70	1	0	0	0	0	29	4	2545	49	83	-
24128	6/26/1996	5	65	0	0	0	0	0	17	4	2546	48	93	-
24128	6/26/1996	6	65	1	0	0	0	0	19	10	2547	51	80	-
24128	6/26/1996	7	65	1	0	0	0	0	19	9	2548	51	86	-
24128	6/26/1996	8	60	1	0	0	0	0	16	4	2548	51	93	-

Site	Date	Hour	CeilingH	Rain	Drizzle	Snow	Snow Shower	Ice Pellets	WD	WS	Stn P	T	RH	Sky Cover
24128	6/26/1996	9	50	1	0	0	0	0	19	7	2548	52	93	-
24128	6/26/1996	10	34	1	0	0	0	0	13	8	2548	52	93	-
24128	6/26/1996	11	---	0	0	0	0	0	22	7	2546	54	86	0
24128	6/26/1996	12	---	0	0	0	0	0	6	10	2546	57	75	0
24128	6/26/1996	13	---	0	0	0	0	0	3	15	2542	58	75	0
24128	6/26/1996	14	---	0	0	0	0	0	5	11	2542	59	72	0
24128	6/26/1996	15	---	0	0	0	0	0	1	3	2540	64	54	0
24128	6/26/1996	16	50	2	0	0	0	0	15	27	2546	49	90	-
24128	6/26/1996	17	50	0	0	0	0	0	0	0	2545	52	83	-
24128	6/26/1996	18	---	0	0	0	0	0	36	5	2545	52	86	0
24128	6/26/1996	19	---	0	0	0	0	0	0	0	2547	50	90	3
24128	6/26/1996	20	50	0	0	0	0	0	14	7	2549	50	90	-
24128	6/26/1996	21	70	1	0	0	0	0	18	6	2550	49	90	7
24128	6/26/1996	22	60	0	0	0	0	0	18	12	2550	49	90	-
24128	6/26/1996	23	---	0	0	0	0	0	19	6	2550	47	89	3
24128	10/30/1996	0	---	0	0	0	0	0	7	5	2552	38	86	3
24128	10/30/1996	1	60	0	0	0	0	0	14	4	2552	36	97	-
24128	10/30/1996	2	65	0	0	0	0	0	14	4	2553	36	93	-
24128	10/30/1996	3	44	0	0	0	0	0	0	0	2553	37	93	-
24128	10/30/1996	4	46	1	0	0	0	0	18	3	2553	36	96	-
24128	10/30/1996	5	48	0	0	0	0	0	0	0	2553	36	97	-
24128	10/30/1996	6	60	0	0	0	0	0	6	7	2551	39	89	-
24128	10/30/1996	7	70	0	0	0	0	0	11	8	2552	38	93	-
24128	10/30/1996	8	32	0	0	0	0	0	15	4	2554	37	93	-
24128	10/30/1996	9	85	0	0	0	0	0	7	5	2553	40	86	7
24128	10/30/1996	10	80	0	0	0	0	0	6	4	2552	43	76	-
24128	10/30/1996	11	34	1	0	0	0	0	0	0	2552	43	76	-
24128	10/30/1996	12	34	1	0	0	0	0	15	3	2549	42	79	-
24128	10/30/1996	13	55	0	0	0	0	0	0	0	2548	43	76	-
24128	10/30/1996	14	29	1	0	0	0	0	0	0	2546	43	76	-
24128	10/30/1996	15	20	2	0	0	0	0	16	5	2546	40	89	-
24128	10/30/1996	16	55	0	0	0	0	0	0	0	2546	41	86	-
24128	10/30/1996	17	75	0	0	0	0	0	29	4	2546	40	93	-
24128	10/30/1996	18	80	0	0	0	0	0	0	0	2547	39	93	-
24128	10/30/1996	19	21	0	0	0	0	0	29	5	2548	38	97	-
24128	10/30/1996	20	17	0	0	0	0	0	31	4	2548	38	93	-
24128	10/30/1996	21	38	0	0	0	0	0	30	4	2548	38	97	-
24128	10/30/1996	22	75	0	0	0	0	0	1	7	2547	39	89	-
24128	10/30/1996	23	75	0	0	0	0	0	3	12	2548	39	89	-

Table A-2. Summary of hourly surface meteorological observations at NWS site nearest to the Zion Class I area on most days the CALPUFF-estimated visibility impacts exceed the 5% visibility threshold.

Site	Date	Hour	Ceiling H	Rain	Drizzle	Snow	Snow Shower	Ice Pellets	WD	WS	StnP	T	RH	Sky Cover
93129	1/29/2001	0	16	0	0	0	0	0	250	3	2427	27	93	-
93129	1/29/2001	1	8	0	0	0	0	0	0	0	2424	27	93	-
93129	1/29/2001	2	20	0	0	0	0	0	0	0	2422	27	86	-
93129	1/29/2001	3	20	0	0	0	0	0	0	0	2419	25	93	-
93129	1/29/2001	4	20	0	0	0	0	0	330	3	2416	25	93	-
93129	1/29/2001	5	1	0	0	0	0	0	0	0	2415	25	100	-
93129	1/29/2001	6	1	0	0	0	0	0	270	5	2413	27	93	-
93129	1/29/2001	7	1	0	0	0	0	0	350	5	2411	27	100	-
93129	1/29/2001	8	3	0	0	0	0	0	310	4	2409	27	93	-
93129	1/29/2001	9	5	0	0	0	0	0	320	6	2407	27	100	-
93129	1/29/2001	10	5	0	0	0	0	0	320	8	2405	28	93	-
93129	1/29/2001	11	5	0	0	0	0	0	350	9	2403	30	86	-
93129	1/29/2001	12	13	0	0	0	0	0	331	0	2399	30	86	-
93129	1/29/2001	13	13	0	0	0	0	0	301	1	2395	30	86	-
93129	1/29/2001	14	10	0	0	0	0	0	291	3	2392	30	86	-
93129	1/29/2001	15	33	0	0	1	0	0	301	1	2391	32	80	-
93129	1/29/2001	16	41	0	0	1	0	0	270	8	2390	30	93	-
93129	1/29/2001	17	0	0	0	1	0	0	270	9	2388	32	93	-
93129	1/29/2001	18	15	0	0	1	0	0	290	9	2386	32	93	-
93129	1/29/2001	19	11	0	0	1	0	0	270	8	2384	32	93	-
93129	1/29/2001	20	26	0	0	1	0	0	301	0	2383	32	93	-
93129	1/29/2001	21	29	0	0	1	0	0	321	2	2383	34	87	-
93129	1/29/2001	22	16	0	0	1	0	0	311	6	2382	34	87	-
93129	1/29/2001	23	22	0	0	1	0	0	291	5	2384	34	87	-
93129	11/23/2001	0	---	0	0	0	0	0	60	5	2391	34	100	0
93129	11/23/2001	1	---	0	0	0	0	0	60	5	2390	34	93	0
93129	11/23/2001	2	---	0	0	0	0	0	40	4	2388	37	93	0
93129	11/23/2001	3	---	0	0	0	0	0	50	6	2388	37	93	5
93129	11/23/2001	4	13	0	0	0	0	0	40	7	2387	45	87	9
93129	11/23/2001	5	4	1	0	0	0	0	50	7	2385	45	93	-
93129	11/23/2001	6	4	0	0	0	0	0	20	4	2384	45	93	-
93129	11/23/2001	7	4	0	0	0	0	0	320	5	2384	45	100	-
93129	11/23/2001	8	4	1	0	0	0	0	340	9	2382	45	100	-
93129	11/23/2001	9	8	1	0	0	0	0	331	1	2381	45	100	-
93129	11/23/2001	10	9	1	0	0	0	0	331	3	2379	45	93	-
93129	11/23/2001	11	5	1	0	0	0	0	331	1	2379	45	100	-
93129	11/23/2001	12	6	0	0	0	0	0	291	1	2376	46	93	-
93129	11/23/2001	13	6	1	0	0	0	0	320	9	2375	46	93	-
93129	11/23/2001	14	10	0	0	0	0	0	321	3	2376	46	93	-
93129	11/23/2001	15	10	0	0	0	0	0	331	4	2378	46	93	-
93129	11/23/2001	16	12	0	0	0	0	0	321	0	2380	46	93	-
93129	11/23/2001	17	12	0	0	0	0	0	321	1	2381	45	93	-
93129	11/23/2001	18	14	0	0	0	0	0	321	3	2382	45	93	-
93129	11/23/2001	19	14	0	0	0	0	0	321	7	2383	45	87	-
93129	11/23/2001	20	16	0	0	0	0	0	321	8	2384	43	87	-
93129	11/23/2001	21	16	0	0	0	0	0	321	9	2384	41	93	-
93129	11/23/2001	22	22	0	0	0	0	0	321	7	2383	41	93	-
93129	11/23/2001	23	16	1	0	0	0	0	322	3	2380	41	93	-
93129	4/8/2002	0	4	0	0	0	0	0	90	5	2416	48	100	-
93129	4/8/2002	1	2	0	0	0	0	0	30	3	2417	48	100	-
93129	4/8/2002	2	2	1	0	0	0	0	10	7	2417	48	100	-
93129	4/8/2002	3	4	2	0	0	0	0	50	5	2420	48	100	-
93129	4/8/2002	4	5	1	0	0	0	0	20	5	2422	48	100	-
93129	4/8/2002	5	41	0	0	0	0	0	341	2	2423	48	100	-
93129	4/8/2002	6	5	0	0	0	0	0	361	0	2425	50	94	-
93129	4/8/2002	7	5	1	0	0	0	0	361	0	2426	50	94	-
93129	4/8/2002	8	10	1	0	0	0	0	11	5	2428	50	94	9
93129	4/8/2002	9	6	0	0	0	0	0	11	5	2430	50	94	9
93129	4/8/2002	10	13	0	0	0	0	0	361	3	2434	50	94	9
93129	4/8/2002	11	---	0	0	0	0	0	21	9	2435	52	82	3

Site	Date	Hour	Ceiling H	Rain	Drizzle	Snow	Snow Shower	Ice Pellets	WD	WS	StnP	T	RH	Sky Cover
93129	4/8/2002	12	---	0	0	0	0	0	31	3	2438	50	88	3
93129	4/8/2002	13	---	0	0	0	0	0	31	3	2439	52	82	3
93129	4/8/2002	14	---	0	0	0	0	0	30	9	2439	55	67	0
93129	4/8/2002	15	---	0	0	0	0	0	40	6	2439	57	63	0
93129	4/8/2002	16	---	0	0	0	0	0	70	6	2440	57	63	5
93129	4/8/2002	17	49	0	0	0	0	0	360	9	2442	57	59	9
93129	4/8/2002	18	59	0	0	0	0	0	350	7	2444	55	63	-
93129	4/8/2002	19	59	0	0	0	0	0	10	5	2445	52	72	-
93129	4/8/2002	20	59	0	0	0	0	0	10	7	2449	48	76	9
93129	4/8/2002	21	---	0	0	0	0	0	30	6	2450	43	81	0
93129	4/8/2002	22	---	0	0	0	0	0	60	4	2451	39	87	0
93129	4/8/2002	23	---	0	0	0	0	0	320	4	2455	39	87	0
93129	10/3/2002	0	5	0	0	0	0	0	21	0	2449	45	93	-
93129	10/3/2002	1	5	0	0	0	0	0	10	9	2448	43	100	-
93129	10/3/2002	2	20	1	0	0	0	0	40	8	2447	43	100	-
93129	10/3/2002	3	6	0	0	0	0	0	30	7	2445	43	100	-
93129	10/3/2002	4	6	0	0	0	0	0	50	7	2445	43	100	-
93129	10/3/2002	5	5	1	0	0	0	0	60	7	2442	43	100	-
93129	10/3/2002	6	3	1	0	0	0	0	70	6	2442	43	100	-
93129	10/3/2002	7	---	0	0	0	0	0	70	4	2442	45	93	-
93129	10/3/2002	8	1	0	0	0	0	0	110	5	2442	45	100	-
93129	10/3/2002	9	2	0	0	0	0	0	120	7	2439	46	93	-
93129	10/3/2002	10	2	0	0	0	0	0	100	5	2436	46	100	-
93129	10/3/2002	11	2	0	0	0	0	0	110	7	2434	48	100	-
93129	10/3/2002	12	2	0	0	0	0	0	100	5	2430	52	100	-
93129	10/3/2002	13	1	1	0	0	0	0	310	3	2426	52	100	-
93129	10/3/2002	14	3	0	0	0	0	0	50	9	2420	52	100	-
93129	10/3/2002	15	7	1	0	0	0	0	310	4	2422	52	100	9
93129	10/3/2002	16	15	1	0	0	0	0	330	6	2417	52	100	-
93129	10/3/2002	17	17	0	0	0	0	0	330	9	2416	52	94	-
93129	10/3/2002	18	20	0	0	0	0	0	320	8	2417	52	94	-
93129	10/3/2002	19	24	0	0	0	0	0	260	5	2417	52	94	9
93129	10/3/2002	20	---	0	0	0	0	0	300	3	2417	48	100	0
93129	10/3/2002	21	---	0	0	0	0	0	120	6	2414	48	100	3
93129	10/3/2002	22	1	0	0	0	0	0	190	3	2416	46	100	-
93129	10/3/2002	23	1	0	0	0	0	0	350	9	2417	48	100	9
93129	10/31/2002	0	10	0	0	0	0	0	361	0	2473	25	86	-
93129	10/31/2002	1	10	0	0	1	0	0	10	9	2473	25	86	-
93129	10/31/2002	2	28	0	0	0	0	0	21	0	2472	25	86	-
93129	10/31/2002	3	22	0	0	0	0	0	360	9	2473	25	86	-
93129	10/31/2002	4	22	0	0	0	0	0	360	8	2473	23	86	-
93129	10/31/2002	5	22	0	0	0	0	0	10	8	2473	23	86	-
93129	10/31/2002	6	20	0	0	1	0	0	10	6	2472	23	86	-
93129	10/31/2002	7	1	0	0	1	0	0	10	6	2473	21	93	-
93129	10/31/2002	8	1	0	0	1	0	0	360	8	2477	21	93	-
93129	10/31/2002	9	---	0	0	0	0	0	360	8	2476	23	86	5
93129	10/31/2002	10	32	0	0	0	0	0	20	6	2476	25	80	9
93129	10/31/2002	11	---	0	0	0	0	0	20	7	2474	25	80	5
93129	10/31/2002	12	46	0	0	0	0	0	30	6	2471	25	80	9
93129	10/31/2002	13	14	0	0	0	0	0	20	6	2471	27	80	9
93129	10/31/2002	14	---	0	0	0	0	0	20	6	2470	27	80	3
93129	10/31/2002	15	---	0	0	0	0	0	10	6	2470	27	80	5
93129	10/31/2002	16	16	0	0	0	0	0	10	8	2471	27	74	9
93129	10/31/2002	17	28	0	0	0	0	0	10	8	2472	25	86	9
93129	10/31/2002	18	---	0	0	0	0	0	20	9	2473	25	86	5
93129	10/31/2002	19	41	0	0	0	0	0	30	8	2473	25	86	9
93129	10/31/2002	20	16	0	0	0	0	0	10	8	2475	25	86	9
93129	10/31/2002	21	20	0	0	0	0	0	10	8	2476	25	86	-
93129	10/31/2002	22	20	0	0	0	0	0	350	8	2478	25	86	-
93129	10/31/2002	23	20	0	0	0	0	0	10	6	2478	25	80	-
93129	11/3/2002	0	3	0	0	0	0	0	260	5	2451	36	93	-
93129	11/3/2002	1	7	0	0	0	0	0	250	4	2450	36	93	-

Site	Date	Hour	Ceiling H	Rain	Drizzle	Snow	Snow Shower	Ice Pellets	WD	WS	StnP	T	RH	Sky Cover
93129	11/3/2002	2	48	0	0	0	0	0	260	5	2450	34	100	9
93129	11/3/2002	3	---	0	0	0	0	0	260	5	2448	32	93	0
93129	11/3/2002	4	---	0	0	0	0	0	281	0	2449	32	87	0
93129	11/3/2002	5	---	0	0	0	0	0	290	9	2450	34	81	0
93129	11/3/2002	6	---	0	0	0	0	0	280	9	2450	32	87	0
93129	11/3/2002	7	---	0	0	0	0	0	290	9	2452	34	87	0
93129	11/3/2002	8	---	0	0	0	0	0	281	4	2455	37	75	0
93129	11/3/2002	9	---	0	0	0	0	0	311	7	2456	39	70	0
93129	11/3/2002	10	---	0	0	0	0	0	311	7	2456	43	61	0
93129	11/3/2002	11	---	0	0	0	0	0	311	4	2456	45	57	0
93129	11/3/2002	12	---	0	0	0	0	0	311	8	2456	45	57	0
93129	11/3/2002	13	---	0	0	0	0	0	301	5	2454	46	50	0
93129	11/3/2002	14	---	0	0	0	0	0	281	3	2454	48	46	0
93129	11/3/2002	15	---	0	0	0	0	0	331	4	2456	46	50	0
93129	11/3/2002	16	---	0	0	0	0	0	301	0	2457	45	57	0
93129	11/3/2002	17	---	0	0	0	0	0	310	5	2458	39	70	0
93129	11/3/2002	18	---	0	0	0	0	0	290	7	2459	37	70	0
93129	11/3/2002	19	---	0	0	0	0	0	300	7	2459	34	75	0
93129	11/3/2002	20	---	0	0	0	0	0	310	9	2458	34	75	0
93129	11/3/2002	21	---	0	0	0	0	0	280	7	2460	34	75	0
93129	11/3/2002	22	---	0	0	0	0	0	270	6	2461	32	75	0
93129	11/3/2002	23	---	0	0	0	0	0	270	5	2460	30	80	0
93129	1/6/1996	0	---	0	0	0	0	0	0	0	2459	23	84	0
93129	1/6/1996	1	---	0	0	0	0	0	0	0	2462	22	88	0
93129	1/6/1996	2	---	0	0	0	0	0	190	5	2463	20	92	3
93129	1/6/1996	3	---	0	0	0	0	0	0	0	2464	21	89	0
93129	1/6/1996	4	---	0	0	0	0	0	0	0	2464	22	85	3
93129	1/6/1996	5	---	0	0	0	0	0	0	0	2467	21	89	9
93129	1/6/1996	6	---	0	0	0	0	0	0	0	2467	21	89	9
93129	1/6/1996	7	---	0	0	0	0	0	0	0	2467	19	92	9
93129	1/6/1996	8	---	0	0	0	0	0	0	0	2468	23	84	9
93129	1/6/1996	9	---	0	0	0	0	0	20	5	2472	30	72	9
93129	1/6/1996	10	---	0	0	0	0	0	20	5	2470	37	52	9
93129	1/6/1996	11	---	0	0	0	0	0	340	5	2472	37	55	9
93129	1/6/1996	12	---	0	0	0	0	0	50	4	2469	43	43	9
93129	1/6/1996	13	---	0	0	0	0	0	330	7	2468	45	38	9
93129	1/6/1996	14	---	0	0	0	0	0	30	8	2469	46	36	9
93129	1/6/1996	15	---	0	0	0	0	0	350	4	2468	43	40	9
93129	1/6/1996	16	---	0	0	0	0	0	350	4	2469	45	37	9
93129	1/6/1996	17	---	0	0	0	0	0	160	4	2470	36	50	9
93129	1/6/1996	18	---	0	0	0	0	0	200	4	2471	33	59	9
93129	1/6/1996	19	---	0	0	0	0	0	180	4	2473	33	59	9
93129	1/6/1996	20	---	0	0	0	0	0	150	6	2473	30	67	9
93129	1/6/1996	21	---	0	0	0	0	0	280	4	2473	28	72	9
93129	1/6/1996	22	---	0	0	0	0	0	110	4	2474	27	81	3
93129	1/6/1996	23	---	0	0	0	0	0	0	0	2474	28	78	3
93129	3/16/1996	0	---	0	0	0	0	0	0	0	2444	41	55	0
93129	3/16/1996	1	---	0	0	0	0	0	0	0	2444	34	78	0
93129	3/16/1996	2	---	0	0	0	0	0	0	0	2442	33	79	0
93129	3/16/1996	3	---	0	0	0	0	0	0	0	2442	31	85	0
93129	3/16/1996	4	---	0	0	0	0	0	50	5	2442	31	82	3
93129	3/16/1996	5	---	0	0	0	0	0	30	5	2442	31	85	3
93129	3/16/1996	6	---	0	0	0	0	0	330	6	2444	30	85	0
93129	3/16/1996	7	---	0	0	0	0	0	50	5	2448	36	76	0
93129	3/16/1996	8	---	0	0	0	0	0	11	0	2448	43	63	0
93129	3/16/1996	9	---	0	0	0	0	0	12	1	2449	50	31	0
93129	3/16/1996	10	---	0	0	0	0	0	361	8	2451	51	27	3
93129	3/16/1996	11	---	0	0	0	0	0	351	8	2451	52	23	3
93129	3/16/1996	12	---	0	0	0	0	0	361	5	2449	55	17	3
93129	3/16/1996	13	---	0	0	0	0	0	361	6	2448	55	14	3
93129	3/16/1996	14	---	0	0	0	0	0	21	5	2447	55	19	3
93129	3/16/1996	15	---	0	0	0	0	0	21	7	2447	56	20	9

Site	Date	Hour	Ceiling H	Rain	Drizzle	Snow	Snow Shower	Ice Pellets	WD	WS	StnP	T	RH	Sky Cover
93129	3/16/1996	16	---	0	0	0	0	0	11	5	2447	54	20	9
93129	3/16/1996	17	---	0	0	0	0	0	21	5	2448	53	22	3
93129	3/16/1996	18	---	0	0	0	0	0	21	5	2448	47	29	3
93129	3/16/1996	19	---	0	0	0	0	0	0	0	2448	41	38	3
93129	3/16/1996	20	---	0	0	0	0	0	0	0	2449	38	44	0
93129	3/16/1996	21	---	0	0	0	0	0	0	0	2451	36	50	0
93129	3/16/1996	22	---	0	0	0	0	0	0	0	2450	33	56	0
93129	3/16/1996	23	---	0	0	0	0	0	0	0	2449	33	58	0

APPENDIX B

Cumulative SO_2 Emissions Used in the WPEA
Cumulative SO_2 PSD Increment Consumption Modeling

WPEA Cumulative SO2 Point Sources in Modeling Domain

State	Facility Name	Stk Ht (ft)	Stk Ht (m)	Stk Diam (ft)	Stk Diam(m)	Stk Temp (F)	Setk Temp(k)	Stk Flow (acf/min)	Stk Vel (ft/sec)	Stk Vel(m/s)	SO2 (lb/hr)	UTM E	UTM N
NV03	CLASS 1A -SSX PROJECT/INDEPENDENCE	32.8	9.99744	3.3	1.00584	72	295.3722222	1	0.0019	0.0006	0.032	591760	4584600
NV04	CLASS 1A -SSX PROJECT/INDEPENDENCE	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	2.91	591760	4584600
NV05	CLASS 1A -SSX PROJECT/INDEPENDENCE	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	2.91	591760	4584600
NV06	CLASS 1A -SSX PROJECT/INDEPENDENCE	32.8	9.99744	3.3	1.00584	72	295.3722222	60969	118.8	36.2122	14.49	591760	4584600
NV07	CLASS 1 -HOLLISTER BLOCK DEV PRJ	15	4.572	0.67	0.204216	900	755.3722222	3638.4	172.0	52.4245	1.519	536800	4550500
NV08	CLASS 1 -HOLLISTER BLOCK DEV PRJT	15	4.572	1.33	0.405384	814	707.5944444	14417	173.0	52.7164	6.075	536800	4550500
NV09	CLASS 1 -ELKO SANITARY LANDFILL	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.45	607600	4521200
NV10	CLASS 1 -ELKO SANITARY LANDFILL	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.45	607600	4521200
NV11	CLASS 1 - PILOT PEAK TITLE V	32.8	9.99744	3.3	1.00584	72	295.3722222	60000	116.9	35.6367	14	734420	4522850
NV12	CLASS 1 - PILOT PEAK TITLE V	32.8	9.99744	3.3	1.00584	72	295.3722222	70000	136.4	41.5761	21	734420	4522850
NV13	CLASS 1 - PILOT PEAK TITLE V	32.8	9.99744	3.3	1.00584	72	295.3722222	100000	194.9	59.3945	33.6	734420	4522850
NV14	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.005	568120	4512620
NV15	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.04	568120	4512620
NV16	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.05	568120	4512620
NV17	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.05	568120	4512620
NV18	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.05	568120	4512620
NV19	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.05	568120	4512620
NV20	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.065	568120	4512620
NV21	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.065	568120	4512620
NV22	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.065	568120	4512620
NV23	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.07	568120	4512620
NV24	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.07	568120	4512620
NV25	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.07	568120	4512620
NV26	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.09	568120	4512620

NV27	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.16	568120	4512620
NV28	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	1818.39	3.54	1.0800	0.17	568120	4512620
NV29	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	1818.39	3.54	1.0800	0.17	568120	4512620
NV30	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	129331	252.0	76.8155	12.91	568120	4512620
NV31	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	124782	243.2	74.1136	27.4	568120	4512620
NV32	CLASS 1B -GOLD QUARRY	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	39.53	568120	4512620
NV33	CLASS 1B - GOLDSTRIKE MINE	6.5	1.9812	0.81	0.246888	350	449.8166667	952	30.8	9.3851	0.004	554700	4536310
NV34	CLASS 1B - GOLDSTRIKE MINE	6.5	1.9812	0.81	0.246888	350	449.8166667	901	29.1	8.8824	0.004	554700	4536310
NV35	CLASS 1B - GOLDSTRIKE MINE	49	14.9352	3.5	1.0668	387	470.3722222	20800	36.0	10.9825	0.01	554700	4536310
NV36	CLASS 1B - GOLDSTRIKE MINE	15	4.572	2	0.6096	250	394.2611111	11807	62.6	19.0921	0.021	554700	4536310
NV37	CLASS 1B - GOLDSTRIKE MINE	49	14.9352	4	1.2192	370	460.9277778	51000	67.6	20.6169	0.025	554700	4536310
NV38	CLASS 1B - GOLDSTRIKE MINE	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.046	554700	4536310
NV39	CLASS 1B - GOLDSTRIKE MINE	60	18.288	6.95	2.11836	420	488.7055556	109300	48.0	14.6361	0.047	554700	4536310
NV40	CLASS 1B - GOLDSTRIKE MINE	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.052	554700	4536310
NV41	CLASS 1B - GOLDSTRIKE MINE	100	30.48	3.7	1.12776	195	363.7055556	11420	17.7	5.3956	0.29	554700	4536310
NV42	CLASS 1B - GOLDSTRIKE MINE	64	19.5072	1.33	0.405384	364	457.5944444	5000	60.0	18.2827	0.299	554700	4536310
NV43	CLASS 1B - GOLDSTRIKE MINE	100	30.48	3.7	1.12776	195	363.7055556	11420	17.7	5.3956	0.45	554700	4536310
NV44	CLASS 1B - GOLDSTRIKE MINE	100	30.48	3.7	1.12776	195	363.7055556	11420	17.7	5.3956	0.9	554700	4536310
NV45	CLASS 1B - GOLDSTRIKE MINE	100	30.48	3.7	1.12776	195	363.7055556	11420	17.7	5.3956	0.9	554700	4536310
NV46	CLASS 1B - GOLDSTRIKE MINE	230	70.104	8	2.4384	200	366.4833333	280000	92.8	28.2977	4.28	554700	4536310
NV47	CLASS 1B - GOLDSTRIKE MINE	230	70.104	8	2.4384	200	366.4833333	280000	92.8	28.2977	4.28	554700	4536310
NV48	CLASS 1B - GOLDSTRIKE MINE	24.5	7.4676	4	1.2192	240	388.7055556	43000	57.0	17.3829	10.61	554700	4536310
NV49	CLASS 1B - GOLDSTRIKE MINE	260	79.248	3.92	1.194816	300	422.0388889	49150	67.9	20.6883	44.9	554700	4536310

NV50	CLASS 1A -BARRICK GOLDSTRIKE OXYGEN PLANT	15.09	4.599432	2	0.6096	291	417.0388889	6726	35.7	10.8760	0.012	554600	4536000
NV51	CLASS 1A -BARRICK GOLDSTRIKE OXYGEN PLANT	15.09	4.599432	2	0.6096	291	417.0388889	6726	35.7	10.8760	0.024	554600	4536000
NV52	CLASS 1 PSD OPTC - BOULDER VALLEY POWER PROJ.	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.074	539690	4510070
NV53	CLASS 1 PSD OPTC - BOULDER VALLEY POWER PROJ.	105	32.004	10.5	3.2004	743.9	668.65	114.8	0.022	0.0067	19.1	539690	4510070
NV54	CLASS 1 PSD OPTC - BOULDER VALLEY POWER PROJ.	105	32.004	10.5	3.2004	743.9	668.65	114.8	0.022	0.0067	19.1	539690	4510070
NV55	CLASS 1 PSD OPTC - BOULDER VALLEY POWER PROJ.	105	32.004	10.5	3.2004	743.9	668.65	114.8	0.022	0.0067	19.1	539690	4510070
NV56	CLASS 1 PSD OPTC - BOULDER VALLEY POWER PROJ.	105	32.004	10.5	3.2004	743.9	668.65	114.8	0.022	0.0067	19.1	539690	4510070
NV57	CLASS 1 PSD OPTC - BOULDER VALLEY POWER PROJ.	350	106.68	16	4.8768	160	344.2611111	476000	39.5	12.0265	192.9	539690	4510070
NV58	CLASS 1B -TWIN CREEKS MINE	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.004	485840	4567620
NV59	CLASS 1B -TWIN CREEKS MINE	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.005	485840	4567620
NV60	CLASS 1B -TWIN CREEKS MINE	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.0063	485840	4567620
NV61	CLASS 1B -TWIN CREEKS MINE	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.01	485840	4567620
NV62	CLASS 1B -TWIN CREEKS MINE	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.01	485840	4567620
NV63	CLASS 1B -TWIN CREEKS MINE	32.8	9.99744	3.3	1.00584	72	295.3722222	0.01	0.000019	0.0000	0.1	485840	4567620
NV64	CLASS 1B -TWIN CREEKS MINE	32.8	9.99744	3.3	1.00584	72	295.3722222	48966	95.4	29.0831	33.28	485840	4567620
NV65	PSD - REID-GARDNER GENERATING STATION	270	82.296	12.9	3.93192	145	335.9277778		67.00	20.4216	680.35	711620	4059440

NV66	PSD - REID-GARDNER GENERATING STATION	500	152.4	21	6.4008	145	335.9277778		56.00	17.0688	857.24	711620	4059440
NV76	Lasco Bathware	20.00	6.096	1.83	0.5588	90.0	305.37		67.24	20.4950	0.01	712587	4062663
NV77	Lasco Bathware	20.00	6.096	1.50	0.4572	90.0	305.37		67.24	20.4950	0.01	712588	4062625
NV78	Lasco Bathware	20.00	6.096	1.83	0.5588	90.0	305.37		67.24	20.4950	0.01	712634	4062663
NV79	Lasco Bathware	20.00	6.096	1.50	0.4572	90.0	305.37		67.24	20.4950	0.01	712634	4062625
NV80	Lasco Bathware	39.00	11.8872	3.00	0.9144	224.0	379.82		75.16	22.9090	0.01	712581	4062663
NV81	Simplot Silica Products	50.00	15.24	5.00	1.524	240.0	388.7		37.67	11.4820	7.34	730457	4044128
NV82	Simplot Silica Products	50.00	15.24	5.00	1.524	240.0	388.7		37.67	11.4820	0.06	730484	4044118
NV83	Royal Cement Company	90.00	27.432	10.00	3.048	650.0	616.48		29.71	9.0553	16.6	723301	4058917
NV102	NPC Harry Allen Station	123.36	37.6	11.48	3.5	982.1	801		59.09	18.0100	45.3	688237	4033301
NV103	NPC Harry Allen Station	6.00	1.829	1.00	0.305	885.0	747.04		91.25	27.8130	0.27	688184	4033358
NV104	NPC Harry Allen Station	100.00	30.48	19.00	5.79	202.0	367.59		56.69	17.2800	1	688169	4033533
NV105	NPC Harry Allen Station	100.00	30.48	19.00	5.79	202.0	367.59		56.69	17.2800	1	688129	4033588
NV106	NPC Harry Allen Station	15.00	4.572	0.42	0.127	1004.0	813.15		279.62	85.2280	0.8	688199	4033479
NV107	NPC Harry Allen Station	15.00	4.572	0.42	0.127	1004.0	813.15		279.62	85.2280	1.6	688268	4033393
NV108	NPC Harry Allen Station	60.00	18.288	14.00	4.2672	959.0	788.15		179.00	54.5590	0.64	688202	4033324
NV109	NPC Harry Allen Station	15.42	4.7	0.33	0.1	1550.9	1117		265.75	81.0000	0.31	688150	4033424
NV143	Mirant LLC	170.01	51.82	16.77	5.11	360.4	455.58		69.85	21.2900	1	682932	4031880
NV144	Mirant LLC	170.01	51.82	16.77	5.11	360.4	455.58		69.85	21.2900	1	682925	4031844
NV145	Mirant LLC	36.84	11.23	2.00	0.61	741.5	667.31		0.69	0.2100	0.005	682776	4031688
NV146	Mirant LLC	36.84	11.23	2.00	0.61	741.5	667.31		0.69	0.2100	0.005	682776	4031686
NV147	Mirant LLC	11.06	3.37	0.82	0.25	741.5	667.31		73.92	22.5300	2.4	683032	4031790
NV148	Mirant LLC	14.01	4.27	0.33	0.1	741.5	667.31		273.95	83.5000	0.6	682863	4031820
NV149	NPC SilverHawk Power Plant	150.00	45.72	18.04	5.5	189.8	360.8		68.90	21.0000	1.5	682958	4031122
NV150	NPC SilverHawk Power Plant	150.00	45.72	18.04	5.5	189.8	360.8		68.90	21.0000	1.5	682997	4031147
NV151	NPC SilverHawk Power Plant	15.00	4.572	1.00	0.305	600.0	588.7		60.01	18.2900	0.5	683050	4031234
NV152	NPC SilverHawk Power Plant	20.00	6.096	2.83	0.864	600.0	588.7		85.01	25.9100	0.01	682948	4031274
NV153	Ashgrove Cement (ATC appln)	545.01	166.12	8.83	2.69	231.0	383.71		104.20	31.7600	84.00	699293	4044523
NV154	TASCO, Paul	112.00	34.1376	10	3.048	105	313.7055556	98725	21.0	6.3856	72.8	765970	4722588
NV155	TASCO, Paul	112.00	34.1376	10	3.048	105	313.7055556	98725	21.0	6.3856	0.016	765970	4722588
NV156	TASCO, Paul	112.00	34.1376	10	3.048	105	313.7055556	98725	21.0	6.3856	58.6	765960	4722588

NV157	TASCO, Paul	99.00	30.1752	6	1.8288	145	335.9277778	32012	18.9	5.7516	16.5	765888	4722771
NV158	TASCO, Paul	99.00	30.1752	6	1.8288	166	347.5944444	45007	26.5	8.0864	20.1	765898	4722771
NV159	TASCO, Paul	79.00	24.0792	2.52	0.768096	60	288.7055556	4988	16.7	5.0808	0.78	765961	4722702
NV160	TASCO, Paul	49.00	14.9352	0.67	0.204216	120	322.0388889	2274	107.5	32.7653	0.018	765955	4722711
NV161	TASCO, Paul	52.00	15.8496	0.9	0.27432	160	344.2611111	213	5.58	1.7009	4.37	765972	4722614
NV162	TASCO, Twin Falls	157.00	47.8536	6.6	2.01168	290	416.4833333	101404	49.4	15.0571	186	711018	4711770
NV163	TASCO, Twin Falls	217.00	66.1416	9	2.7432	362	456.4833333	282461	74.0	22.5552	225	711070	4711655
NV164	TASCO, Twin Falls	82.00	24.9936	8	2.4384	166	347.5944444	67949	22.5	6.8671	13.3	710912	4711910
NV165	TASCO, Twin Falls	161.00	49.0728	4	1.2192	187	359.2611111	57302	76.0	23.1647	0.95	710972	4711898
NV166	TASCO, Twin Falls	161.00	49.0728	4	1.2192	187	359.2611111	57302	76.0	23.1647	0.48	710972	4711898
NV167	TASCO, Twin Falls	120.00	36.576	0.67	0.204216	180	355.3722222	254	12.0	3.6569	1.25	710964	4711912
NV168	Nevco Power Pant	462.50	140.97	17.00	5.1816	159.998	344.26	850282	62.43	19.0300	124.87	935678	4311470
NV169	Intermountain Power Plant	712.00	217.0176	28.00	8.5344	114.998	319.26	3055362	82.70	25.2070	454.98	880096	4382612
NV170	Intermountain Power Plant	712.00	217.0176	28.00	8.5344	114.998	319.26	3055362	82.70	25.2070	423.65	880096	4382612
NV171	Intermountain Power Plant	712.00	217.0176	32.00	9.7536	135.05	330.4	3136566	65.00	19.8120	905.02	879936	4382602
NV172	Graymont Western Lime	100.07	30.5	5.50	1.6764	395.33	475	80769	56.66	17.2700	108.58	862670	4318192
NV173	Graymont Western Lime	100.07	30.5	5.00	1.52415	395.33	475	64445	54.69	16.6700	25.94	862649	4318184
NV174	Graymont Western Lime	100.07	30.5	7.00	2.13381	395.33	475	117371	50.82	15.4900	29.44	862627	4318132
NV175	Graymont Western Lime	213.25	65	7.00	2.13381	395.33	475	117348	50.81	15.4870	38.40	862665	4318001
NV176	Polystyrene Foam Production Facility	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	0.0032	843891	4177663
NV177	Veyo Compressor Station	46	14.0208	8	2.4384	911	761.4833333	56332.80	18.68	5.6932	0.22	793729	4138458
NV178	Veyo Compressor Station	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	0.72	793729	4138458
NV179	Veyo Compressor Station	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	0.36	793729	4138458
NV180	Veyo Compressor Station	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	0.0042	793729	4138458
NV181	Veyo Compressor Station	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	0.0022	793729	4138458
NV182	Red Rock Power Generation Station	45	13.716	3.5	1.0668	675	630.3722222	63480.00	109.97	33.5177	0.21	804994	4111226
NV183	Red Rock Power Generation Station	45	13.716	3.5	1.0668	675	630.3722222	63480.00	109.97	33.5177	0.14	804994	4111226
NV184	Asphalt Plant in Ft. Pierce Industrial park	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	0.74	801321	4106683
NV185	Aggregate Mining	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	2.71	802645	4106366
NV186	Sorenson Pit	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	1.14	803107	4113312
NV187	Washington County Sanitary Landfill	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	4.99	804105	4139027
NV188	Dixie Regional Hospital	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	6.07	806087	4111239

	(New)												
NV189	Concrete Block Facility	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	0.60	806515	4105408
NV190	Ft. Pearce Concrete Batch & Aggregate Plants	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	2.94	807286	4104935
NV191	Fort Pierce Pit	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	6.85	808156	4104810
NV192	Aggregate Plant - Fort Pierce Industrial Park	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	2.75	808823	4106957
NV193	Aggregate Crushing - SR 9 Pit	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	2.08	816958	4119403
NV194	Hurricane Pit	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	0.75	822923	4120121
NV195	Cedar City Yard & Ready Mix Plant	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	7.50	845457	4180613
NV196	Cedar City Aggregate Processing Plant	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	0.090	845674	4180205
NV197	Asphalt Plant/Crusher/Concrete Plant	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	8.03	845957	4179852
NV198	Cedar City Campus	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	17.02	846597	4176967
NV199	Cedar City Concrete Batching Plant	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	2.01	847417	4179615
NV200	Clark Pit: Aggregate Processing Facility	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	0.090	848059	4194603
NV201	Hildale City Cogeneration Facility	32.8	9.99744	3.3	1.00584	Ambient	293.15	0.01	0.000019	0.0000	1.67	855757	4102512

WPEA Cumulative SO2 Volume Sources in Modeling Domain

		facility name	Release ht	Horizontal	Vertical	SO2	UTME	UTMN
NV19	Volume	Simplot Silica Products	14.99343832	915.5839895	13.94356955	10.84	726784.25	4039557
NV20	Volume	Simplot Silica Products	24.01574803	442.9133858	22.30971129	0.96	730300.12	4044007.25